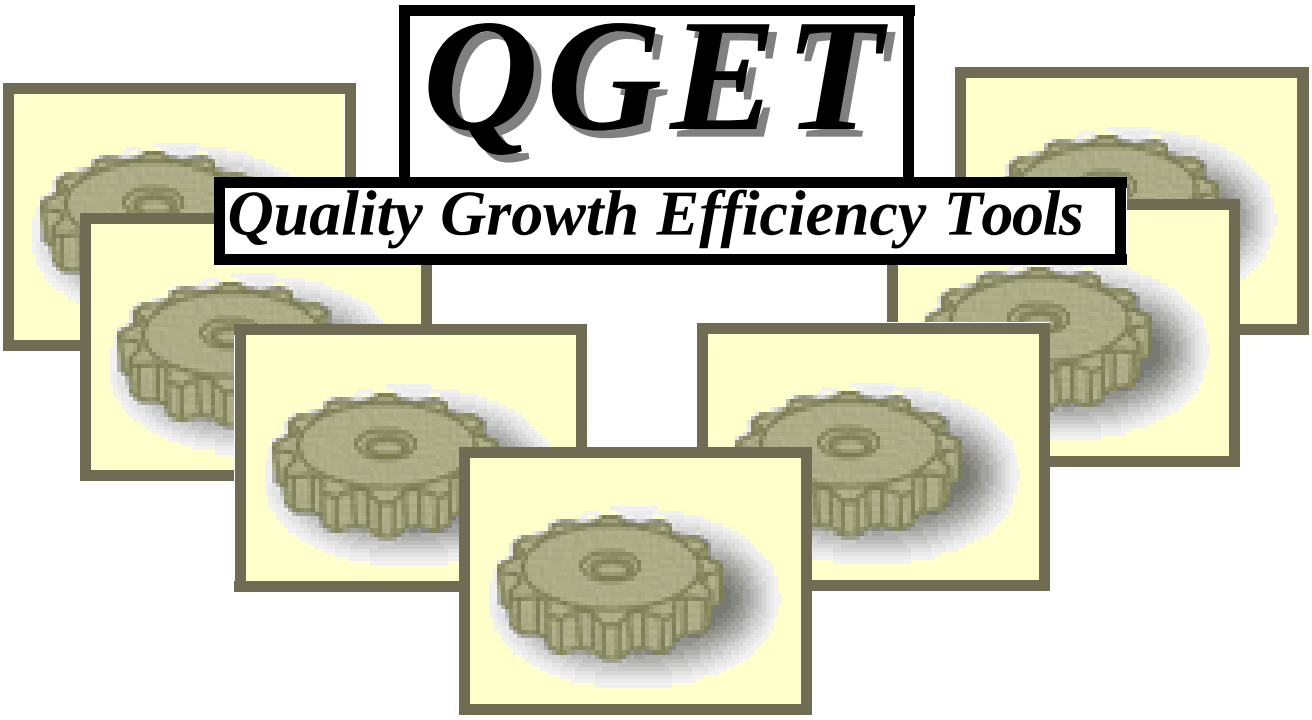
STRATEGY ANALYSIS

May 2000



Governor's Office of Planning and Budget

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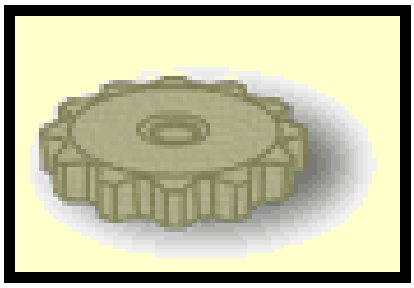

May 2000

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Strategy Analysis: Introduction

Background

Utah's high birth rate, long life expectancy, generally strong economy, and attractive quality of life combine to place growth pressures on communities and regions throughout the state. The quality of this growth remains a dominant issue in the minds of Utahns. In fact, when a random sample of Utahns were asked in an open ended question what the most important issue facing Utah today is, 27% identified growth.[1] This is a higher percentage than any other issue. Growth has held this top position in 16 of the past 17 quarterly surveys asking this same question, even though Utah's economy has been moderating now for five consecutive years. Clearly, Utahns are concerned about growth issues such as traffic congestion, air pollution, the loss of critical lands to urbanization, and the cost of providing public infrastructure.

History of State Involvement

Beginning in 1995, state government initiated explicit and formal efforts to address the growth concerns of the public. The Growth Summit, a jointly sponsored effort of the Governor and Legislature, was held in December of 1995. Over 60 proposals suggesting ways to manage the state's growth were submitted. The Summit resulted in a 10-year transportation improvement plan. Based on this plan, the state is now in the process of rebuilding critical and previously unfunded core highway infrastructure in the state, including the $1.6 billion, 4 ½ year reconstruction of the Interstate 15 corridor in the heart of the Salt Lake metropolitan area.

In 1996, the state partnered with Envision Utah, a public/private community partnership dedicated to studying the effects of long term growth in the state. Governor Leavitt is the Honorary Co-Chair of this effort, and legislative leaders, as well as many of the directors of state departments, serve as partners of Envision Utah.

The primary contribution from state government to the Envision Utah partnership is the technical work of state agencies. This support began in 1996 and is known as QGET, which stands for Quality Growth Efficiency Tools. In essence, QGET combines the expertise of the very best transportation, air quality, water, economic, demographic, and mapping experts in the state into one, integrated modeling endeavor. Local government experts are involved as well. The result is a coordinated effort which simultaneously provides technical support to Envision Utah and other planning efforts, as well as improving the longer term capabilities of the state to formally model and understand growth.

Working with its local government and private sector partners, QGET analysts have analyzed the transportation, air quality, land use, and water characteristics of alternative futures, and the expected infrastructure costs of each of these. This analysis has taken the form of a projected baseline future (the future based on existing trends), four alternative futures (designed to delineate a spectrum of choices and widely recognized as Scenarios A, B, C, and D), and, now, the Quality Growth Strategy.

[1]Valley Research, Inc., Utah Consumer Survey, January 2000

Prior efforts of QGET are documented on the Internet (address shown below) and in these publications, all available from the Utah Governor's Office of Planning and Budget:

- http://www.qget.state.ut.us
- *Baseline Scenario*, QGET Technical Committee, September 1997
- *QGET Data Book*, QGET Technical Committee, June 1998
- *Scenario Analysis*, QGET Technical Committee, March 1999
- *Envision Utah Quality Growth Strategy and Technical Review*, Envision Utah, January 2000

In 1999, the Utah Legislature passed the Quality Growth Act of 1999. This act formed a Quality Growth Commission to help advise the legislature on growth issues, and enhanced the state's critical land preservation fund (called the LeRay McCallister Fund). In addition to advising the legislature, the Quality Growth Commission appropriates monies from the LeRay McCallister fund and distributes planning grants for quality growth projects around the state.

The Quality Growth Commission and Envision Utah are each involved in related, as well as separate, planning activities. See Appendix D for a description of the similarities and differences of each, as well as a description of the coordination present. For more information on the Quality Growth Commission consult the following website and publication (also available from the Governor's Office of Planning and Budget):

- http://www.governor.state.ut.us/planning/quality.htm
- *Progress Report to the Utah Legislative Political Subdivisions Interim Committee*, Utah Quality Growth Commission, November 17, 1999

QGET Mission

QGET is fundamentally a statewide effort to improve the quality of information available to plan for Utah's future. The focus of the committee is to enhance the technical modeling tools, data, and processes such that decision makers have growth-related information related to air quality, transportation, water, and land use that is comprehensive, reliable, accessible, and consistent.

Since its founding in 1996, the objectives of the QGET technical committee have been twofold: 1.) Improve the technical and analytical models used to understand growth, and 2.) Improve the processes and procedures that accompany the management of the data and models. The original goals developed by the Technical Committee in 1996 remain the general organizing framework for QGET's work today:

- Facilitate the sharing of growth-related information to all interested persons and entities;
- Strengthen the collaboration and communication among planning entities;
- Enhance the integration of current planning models, processes, and resources;
- Improve knowledge about current and future land use;
- Develop the capability to comprehensively analyze alternative growth scenarios;

- Enhance and encourage public discussion about planning for the future by providing improved analytical capacity and presentation of information.

QGET Support of Planning Efforts

QGET's technical support of Envision Utah is one, albeit the most visible, of many important planning efforts supported by QGET. QGET, in one form or another, also provides technical support to these and other planning efforts:

- Regional economic and demographic projections (Governor's Office of Planning and Budget)
- Transportation system planning and evaluation (Utah Department of Transportation, Mountainland Association of Governments, Wasatch Front Regional Council, and the Utah Transit Authority)
- Air quality analysis and regulatory planning (Department of Environmental Quality)
- Water supply and distribution system planning and analysis (Department of Natural Resources)
- Current and projected land use (Automated Geographic Reference Center)
- Affordable housing planning (Department of Community and Economic Development)
- 21st Century Community Program (Governor's Rural Partnership Office)
- Quality Growth Commission (staffed by the Governor's Office of Planning and Budget)

QGET Products

QGET has developed several products in addition to the publications and website identified earlier. At the onset, QGET compiled an inventory of planning models used in Utah. QGET has also developed or assisted with the development of new models to improve analysts' understanding of air pollution, infrastructure costs, auto ownership (a key component of transportation modeling), and land use. Many of these are referenced in the Technical Disclosure section and Appendix B and G of this document.

Perhaps most importantly, QGET has generated, purchased, organized and shared a significant amount of data to assist with decision making in the state. For example, the QGET data and analysis, which is available free of charge to anyone who can use it, includes the integration of 60 local government master plans; 7 gigabytes of GIS data; air quality measures taken from 25 meteorological stations and 35 industrial point sources of pollution; 1.7 gigabytes of economic and demographic projection data; transportation modeling that considers 10 million daily person trips, 5,000 miles of road, 150 transit routes, and 5,000 transit stops; and development of hundreds of mathematical relationships relating infrastructure cost to density. QGET's data and analysis has been presented to the Governor, legislators, county commissioners, mayors, planners, educators, business leaders, federal agencies, private foundations, and other members of the public in hundreds of presentations during the last four years.

Taken together, the publications, website, inventory of models, development of new models, data and public presentations, have vastly improved the amount and quality of planning information and coordination present in Utah.

Purpose of this Document

This document summarizes the work of QGET since the publication of the *Scenario Analysis* in March 1999. To fully understand the progression of QGET's work, refer to the entire series of publications, starting with the *Baseline Scenario* and *QGET Data Book*, followed by the *Scenario Analysis*, and now this document, the *Strategy Analysis*. This document generally does not repeat model documentation and work that has been referenced in these earlier reports.

The analysis of the Quality Growth Strategy was released in January 2000 and a summary of the technical analysis was also released at this time. While most people are only interested in the analysis, there are many who desire more detail about the methods used. This document attempts to partially address this need. Readers who would like more detail about the data, models and processes used in the analysis of the Quality Growth Strategy will need to contact the relevant technical experts (see members of the QGET Technical Committee shown in Appendix A).

The organization of this report begins with an update of the original technical analysis which accompanied the release of Envision Utah's Quality Growth Strategy in January 2000. The following section describes the creation of the Quality Growth Strategy, including the public process, housing analysis, and creation of a concept map. The "Technical Disclosure" section provides additional detail on the modeling approaches utilized. Those interested in additional modeling documentation should review the "Tools for Analysis" chapter of the *Scenario Analysis* and the "Planning Models" chapter of the *QGET Data Book*. Eight Appendices have been included at the end of this report as additional detail on QGET, the Quality Growth Strategy, and references to other quality growth issues and activities in Utah.

Strategy Analysis: Technical Analysis Summary

Overview

During the past three years, Envision Utah has directed many activities, including an in-depth values study, baseline analysis, more than 100 public workshops, scenario development and analysis, and a million-dollar public awareness campaign. These activities culminated in the development of a regional vision called the Envision Utah Quality Growth Strategy. Envision Utah advocates voluntary adoption of the strategy's components by public and private entities to realize the goals and strategies of the Quality Growth Strategy.

The QGET Technical Committee prepared the Technical Analysis of the Quality Growth Strategy. When compared to the baseline future (the direction the region is currently headed) the Quality Growth Strategy results in many desirable attributes. In 2020, compared to the baseline, it will conserve 171 square miles of land (roughly the current size of Salt Lake City and West Valley City combined); include a more market-driven mix of housing; result in a 7.3% reduction in mobile emissions; include less traffic congestion; and require $4.5 billion less investment in transportation, water, sewer, and utility infrastructure. These results demonstrate that by adopting the principles outlined in the Quality Growth Strategy, the quality of life in the Greater Wasatch Area can be improved in numerous ways.

Envision Utah and QGET

Envision Utah's purpose is to create and advocate a publicly supported growth strategy that will preserve Utah's high quality of life, natural environment, and economic vitality. Envision Utah has directed many activities since its inception, including a values study, a baseline analysis, public workshops, scenario development and analysis, a public awareness campaign, and the development and analysis of a Quality Growth Strategy. Envision Utah operates with private and federal funds and receives no direct state financing. It does, however, receive technical support from the Quality Growth Efficiency Tools (QGET) Technical Committee.

The QGET Technical Committee consists of technical representatives from state and local government, as well as the private sector. These representatives analyze growth issues related to demographics, economics, transportation, air quality, land use, water availability, and infrastructure costs. The Governor's Office of Planning and Budget coordinates QGET's work. The Technical Committee members are listed in Appendix A.

Background

Quality Growth Planning in Utah - Quality growth planning in Utah began with the Growth Summit in 1995, a conference sponsored by legislative leadership and the Governor, intended to develop legislative solutions to the growth challenges facing the state.

The following year the Governor created the Utah Critical Lands Committee. This committee supported numerous open space projects and developed educational materials describing the tools and techniques for open space conservation.[2]

[2]See *Land Conservation in Utah: Tools, Technique, and Initiatives,* Utah Critical Lands Conservation Committee, January 1997.

In 1996, the State formed a partnership with Envision Utah. Governor Leavitt is the Honorary Co-Chair of Envision Utah. The QGET Technical Committee was formed to improve the quality of information available to plan for Utah's future. Envision Utah and QGET have since produced a baseline scenario (1997), four alternative scenarios (1998) and this analysis of the Quality Growth Strategy (2000).

Contributors to Technical Analysis – The QGET Technical Analysis of the Envision Utah Quality Growth Strategy benefitted from the input of 88 cities, 10 counties, 2 metropolitan planning organizations, 5 state agencies, PSOMAS Engineering, and Fregonese Calthorpe Associates.

Limitations of Technical Analysis – The Technical Analysis of the Quality Growth Strategy is meant to provide relevant technical information to the public, decision makers and Envision Utah about the Quality Growth Strategy. It should be thought of as a work in progress, the findings of which will evolve as new and better information becomes available.

The Analysis is limited to the 10-county area termed the Greater Wasatch Area. All modeling was conducted at the regional scale and is not intended for site-specific evaluations. The scope is limited to the subject areas of transportation, air quality, land use, water, and infrastructure costs.

The Quality Growth Strategy

Background - The Envision Utah Quality Growth Strategy is based on extensive input from the general public, civic organizations, business, and public officials. In January 1999, Envision Utah received more than 17,000 responses to a widely distributed questionnaire. These responses led Envision Utah to develop six primary goals. Over the course of 1999, Envision Utah sponsored dozens of workshops to examine issues such as where and how the Greater Wasatch Area should grow and what types of transportation would best serve the area. These workshops also asked participants to discuss how growth should be accommodated, and consider how well their current general plans would preserve quality of life in the face of growth pressures. Workshop participants discussed what aspects of the community should be enhanced and preserved, who could best deal with growth related-issues (e.g. state government, local government, private industry, consumers) and what types of growth related strategies the public would support. Draft strategies were reviewed by the public, elected officials, and technical experts for input regarding political and technical feasibility. Finally, the Quality Growth Strategy was refined to make it consistent with forecasted housing demand. All of this information helped to refine the draft strategies that now make up the Envision Utah Quality Growth Strategy.

Characteristics – The Technical Analysis of the Quality Growth Strategy assumes gradual, voluntary compliance with the Envision Utah strategies. Over the next 20 years, options for voluntary compliance include: various forms of interjurisdictional cooperation, development of a market-based housing mix, additional water conservation, increasing telework, development of a region-wide transit system, and incremental changes in development patterns. The Technical Analysis has shown that the Greater Wasatch Area will be home to approximately one million more people by 2020. The Quality Growth Strategy is designed so that population and employment trends will continue to be consistent with current trends at the county level.

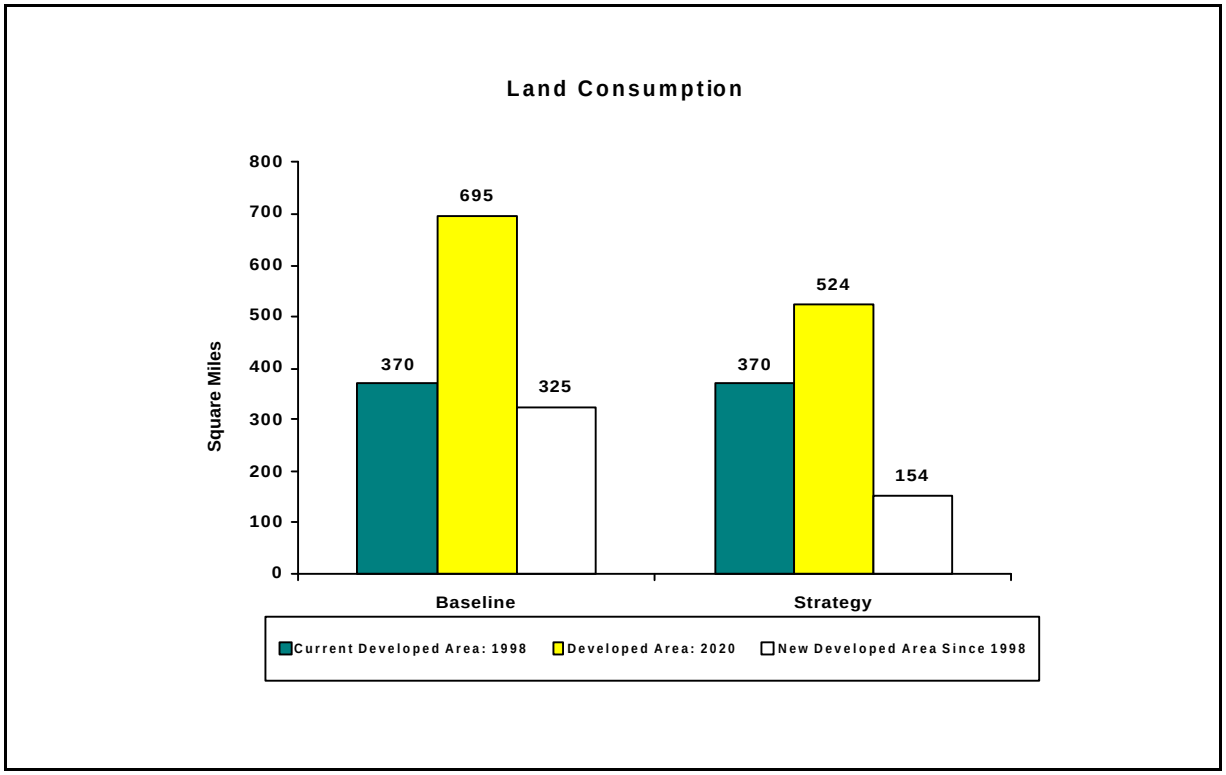
Concept map – The concept map is a visual reflection of the information gleaned by Envision Utah from public involvement and the

technical advice of local officials and the QGET Technical Committee. The map was designed using six layers of information: constrained lands (steep slopes, wetlands, developed and government-owned); critical lands (open space corridors and development buffers); infrastructure (highways and transit); centers and corridors (commercial and industrial centers); newly developed lands (new land committed to urban use between 1997 and 2020); and redeveloped lands (land with existing development and low improvement values). This information was combined to create a visual map, as well as a database of geographically-referenced information.

Baseline – In 1997 the Envision Utah /QGET partnership prepared the Baseline Scenario. This study was comprised of information in current regional and state long-range plans along with the extrapolation of development trends from the last 10-20 years. The study is constrained by long-range population and employment trends for the region. The Baseline Scenario serves as an indication of how the region will develop if current plans and development trends are carried out. The Baseline figures in this analysis represent the second revision of the Baseline Scenario. The Baseline Scenario is used to compare and contrast impacts of the Quality Growth Strategy.

Land Use – The land use analysis is based on a market-driven housing demand forecast, extensive use of infill and reuse development, and mixed use/walkable development patterns. Under the Quality Growth Strategy, 171 square miles less land is converted to urban use than would be converted under the Baseline. This also allows for the conservation of 116 square miles of agricultural land. Under the Baseline a total of 325 square miles will be converted to

Figure 1



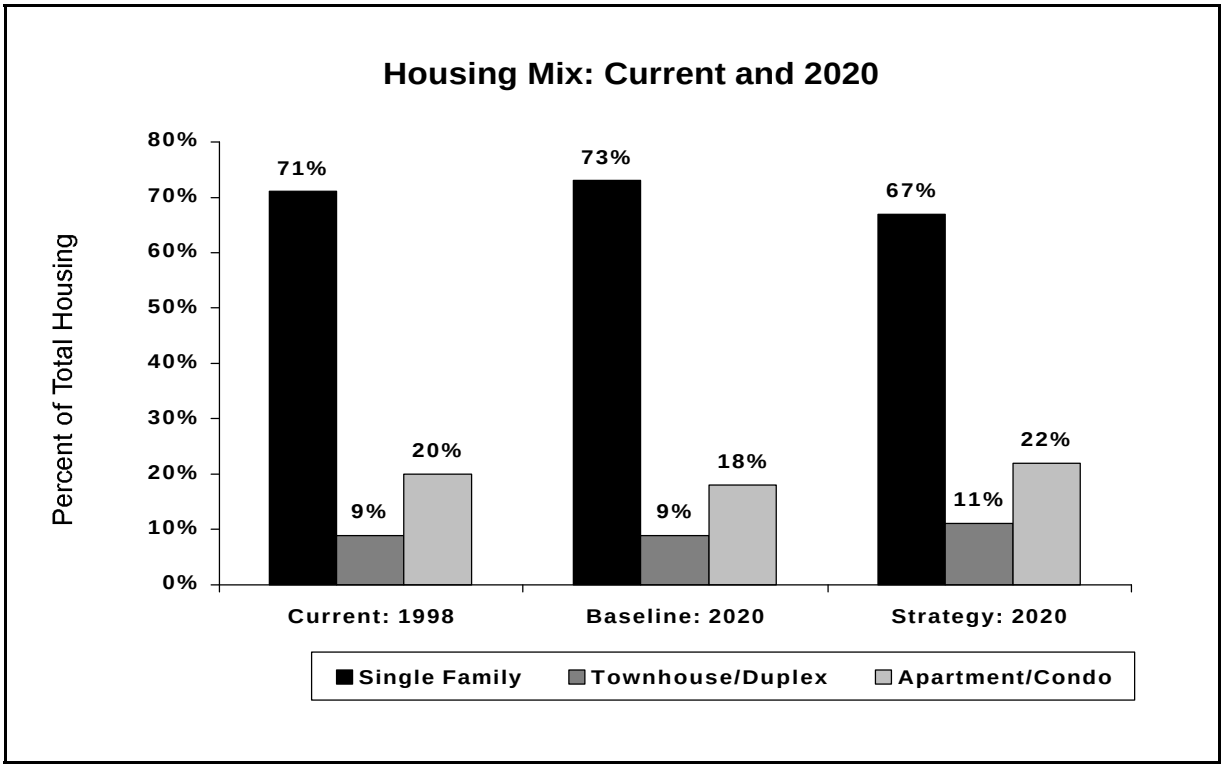
Source: Automated Geographic Reference Center (AGRC)

urban use, compared to a total of 154 square miles under the Quality Growth Strategy. Of the total land converted to urban use, the Baseline will consume 143 square miles of agricultural land compared to 27 square miles under the Quality Growth Strategy

To ensure that the Quality Growth Strategy reflects the housing market, Envision Utah commissioned a housing demand study. The study examined current development trends, constraints that presently exist in the real estate market, and how changes in consumer preferences and regional demographics will affect housing demand in 2020. The study found that the market will predominantly demand single-family units, but to a lesser extent than current zoning ordinances and recent historical trends will supply. Changing demographics will result in some demand shifting away from single family-units (15% less of total 2020 housing compared to the current trend) toward town home/duplexes (9 percent more) and apartment/condos (5 percent more).

Transportation – The transportation system for the Quality Growth Strategy is much like the system designed for the Baseline except that the Quality Growth Strategy utilizes fewer roads and more rail transit. Transportation modeling for the Quality Growth Strategy resulted in a reduction in vehicle miles traveled of 2.4 million per day. At the same time, average speeds increased by 12.5 percent; commute times declined by 5.2 percent; and transit trips increased by 37.5 percent. These system improvements came with a reduction in road spending of approximately $3.5 billion and an increase in transit spending of $1.5 billion for a net savings of $2.0 billion. Transportation experts felt that additional savings could be realized if the transportation system were further refined.

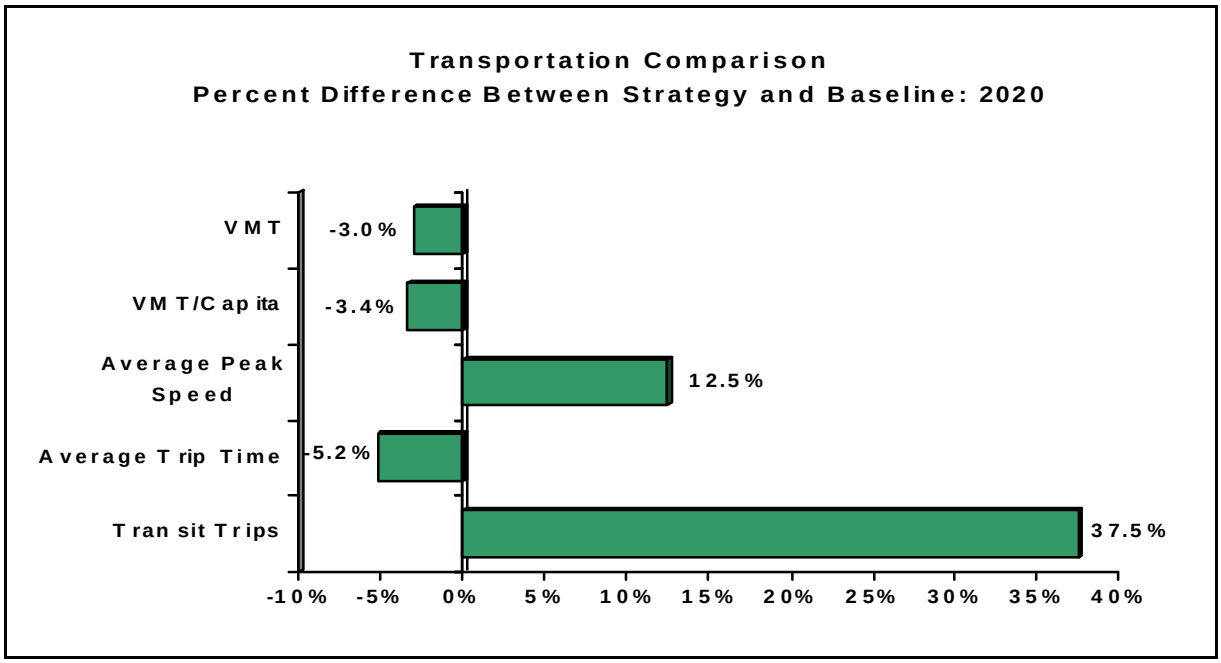
Figure 2



Source: Fregonese Calthorpe Associates

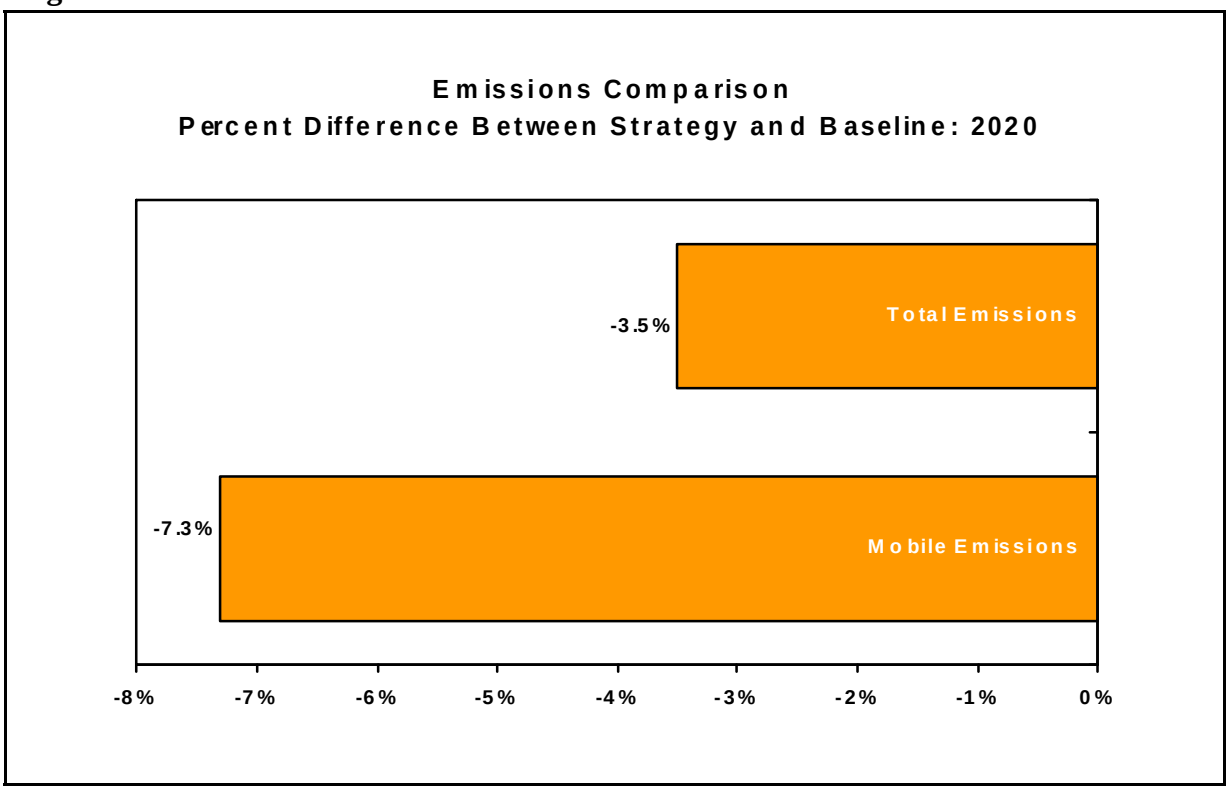
Strategy Analysis

Figure 3



Sources: Wasatch Front Regional Council; Mountainland Association of Government

Figure 4



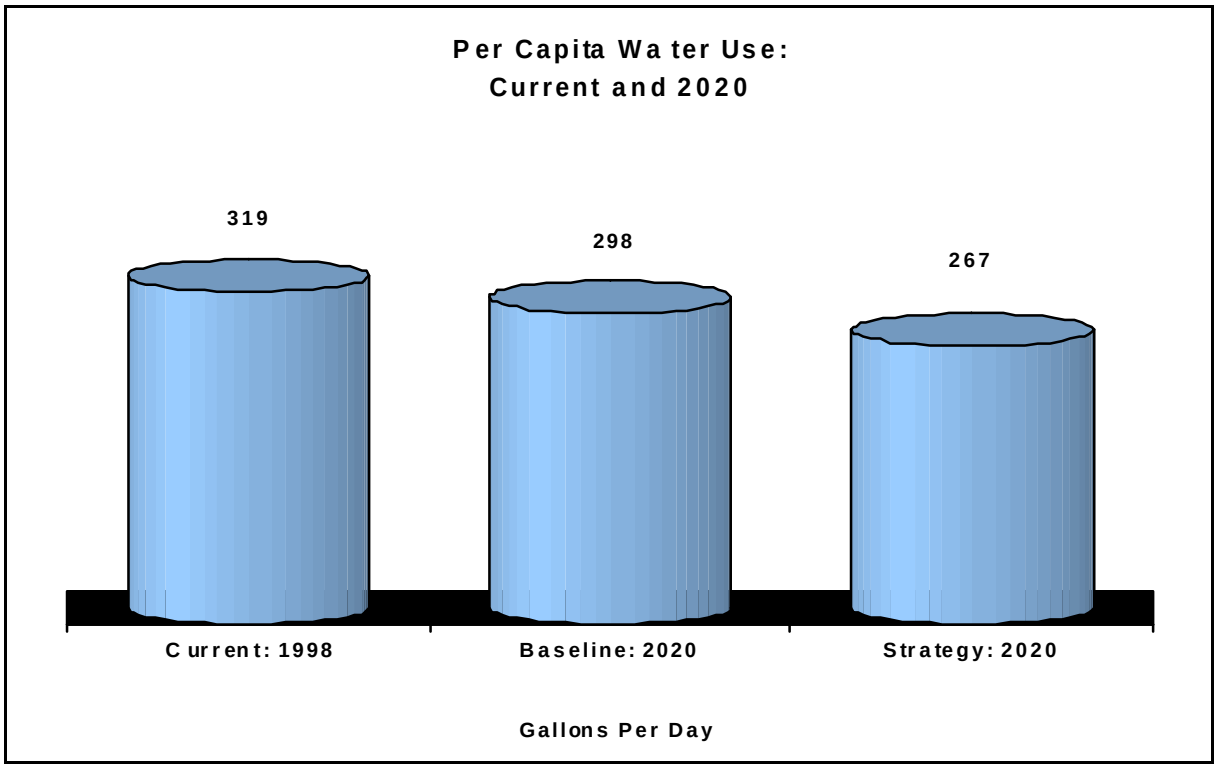
Source: Department of Environmental Quality, Division of Air Quality

Air Quality – The Quality Growth Strategy reduced total emissions by 3.5 percent, a total of 93 tons per day. This occurs solely because of a reduction in mobile emissions of 7.3 percent. This reduction is the result of more transit trips, shorter trip times, and higher average peak speeds.

Water - Current per capita water use in the Greater Wasatch Area is approximately 319 gallons per day. At this rate of consumption, Utah presently ranks second among states in per capita water consumption. Under the Baseline Scenario, per capita water use in 2020 is 298 gallons per person per day. The Quality Growth Strategy results in a per capita use of 267 gallons per day. The Quality Growth Strategy is an excellent forum for achieving a higher reduction/conservation in water consumption through education, incentives and/or regulation. Since the price of water is assumed to be the same in both the Baseline and the Quality Growth Strategy, per capita water use varies between these two scenarios because of changes in land use and in the conservation rate. Land use changes, such as differences in the lot size and allocation of population and employment between the Baseline and the Quality Growth Strategy, help create the lower water use under the Quality Growth Strategy.

Infrastructure – Infrastructure is computed in two categories: regional and sub-regional. Sub-regional is composed of off-site (municipal) and on-site (developer) categories of costs. Regional costs are a function of regional and state planning of activities such as major road arterials, transit networks, and large water development projects. On-site and off-site costs are infrastructure such as local roads, water and sewer mains, storm drain systems, and utilities. Compared to the Baseline, the Quality Growth

Figure 5

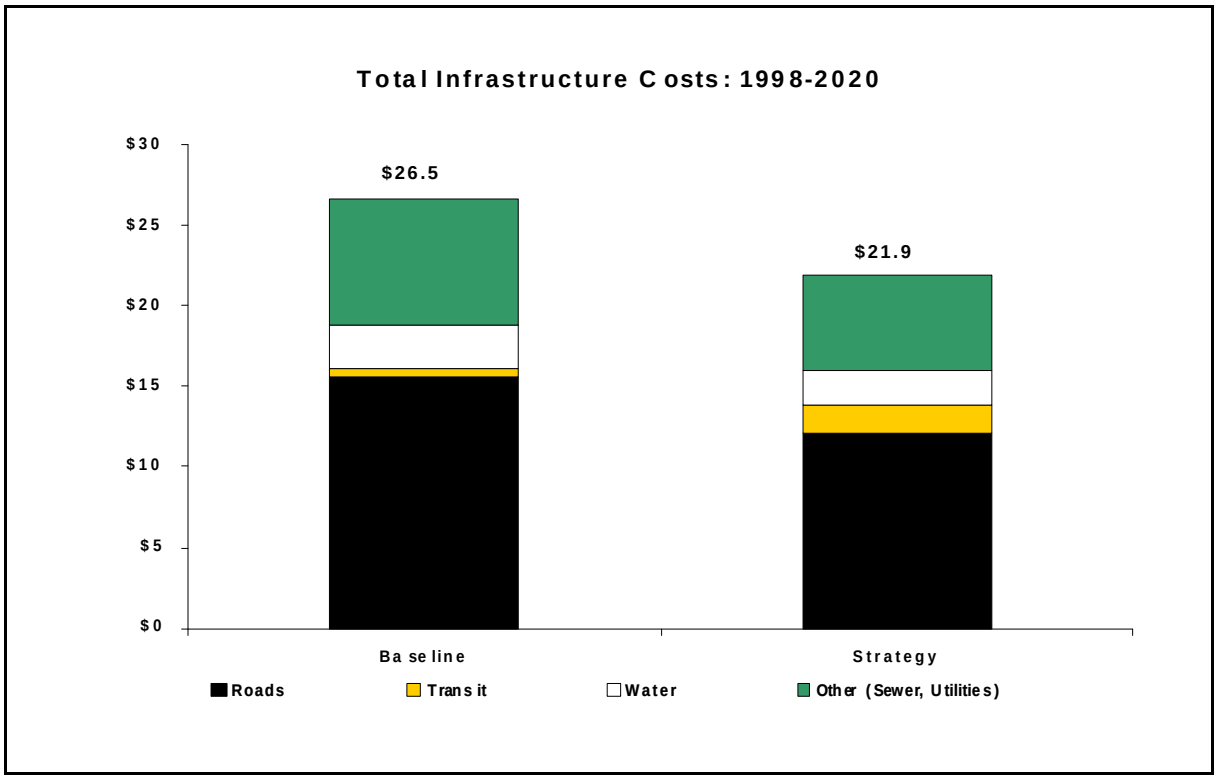


Source: Department of Natural Resources, Division of Water Resources

Strategy reduced total infrastructure cost by $4.5 billion. This translates into a $3.5 billion savings in both regional and sub-regional roads, approximately $0.5 billion savings in regional water, an additional investment of $1.5 billion in public transportation projects, and $20 billion in savings in other infrastructure (sub-regional water, sewer, and utilities).

Summary - The technical analysis was not intended to vary significantly from the Baseline because changes in development are based on an incremental and voluntary basis. The region will reap greater benefits in future time horizons since it takes more than 20 years for the full benefits to be realized. The estimates provided here show that compared to the Baseline, the Quality Growth Strategy can help to preserve the quality of life in Utah by conserving critical lands, reducing mobile emissions, increasing housing choices, improving traffic flows, reducing water consumption, and requiring less infrastructure investment.

Figure 6



Source: Governor's Office of Planning and Budget

Table 1: Envision Utah Quality Growth Strategy: Selected Characteristics in the Year 2020

	Measure	Current**	Baseline	Quality Growth Strategy	Baseline and QGS Differences Absolute	Percentage
Demographics/Economics						
Population	Resident Population	1,687,124	2,695,273	2,695,273	0	0.0%
Households	Number of Households	549,889	952,910	952,910	0	0.0%
Employment	Nonagricultural Jobs	841,581	1,368,024	1,368,024	0	0.0%
Land Use						
Total Developed Area	Square Miles	370	695	524	-171	-24.6%
New Developed Area	Square Miles: 98-2020	--	325	154	-171	-52.6%
Agricultural Land Converted to Urban Use	Square Miles: 98-2020	--	143	27	-116	-81.1%
Population Density	Persons Per Residential Acre	6.0	5.6	7.6	2.0	35.7%
Average Single Family Lot Size	Acres	0.32	0.35	0.29	-0.06	-17.1%
Housing Type						
Single Family	% of Total	71%	73%	67%	-15%	-20.0%
Town House/Duplex	% of Total	9%	9%	11%	9%	225.0%
Apartment/Condo	% of Total	20%	18%	22%	5%	23.8%
Transportation*						
Vehicle Miles Traveled: 10-County Area	Millions	40.7	79.2	76.8	-2.4	-3.0%
VMT Per Capita: 10-County Area		25.1	29.3	28.3	-1	-3.4%
Vehicle Miles Traveled: Metro Counties	Millions	33.4	60.4	57.4	-3	-5.0%
VMT Per Capita: Metro Counties		24.1	26.0	24.8	-1.2	-4.6%
Average Peak Speeds	Miles Per Hour	25.7	20.0	22.5	2.5	12.5%
Average Trip Time	Minutes	18.5	23.2	22.0	-1.2	-5.2%
Transit Trips	Linked Trips Per Weekday	54,000	120,000	165,000	45,000	37.5%
Transit Share of Work Trips	% of Total	3%	3%	5%	2%	59.4%
Proximity to Rail Transit	Population within Half Mile	--	45,557	608,490	562,933	1235.7%
	% of Total	0.0%	1.7%	22.6%	21%	1235.7%
Air Quality*						
Total Emissions (CO, PM, and O3)	Tons Per Day	1,869	2,634	2,541	-93	-3.5%
Mobile Emissions (CO, PM, O3)	Tons Per Day	--	1,212	1,123	-88.7	-7.3%
Distribution of Emissions	Concentration Index (Lower=Better)	--	0.78	0.79	0.01	0.9%
Population-Pollution Coincidence	Coincidence Index (Lower=Better)	--	2.44	2.53	0.09	3.7%
Water						
Total Demand	Acre Feet	698,800	1,008,800	915,600	-93,200	-9.2%
Per Capita Use	Gallons Per Day	319	298	267	-31	-10.4%
Conservation	Percent Reduction by 2020	--	6.3%	12.5%	6.3%	100.0%
Infrastructure Costs						
Regional						
Roads	Billions of 1999 Dollars	--	12.587	9.980	-2.6	-20.7%
Water	Billions of 1999 Dollars	--	0.606	0.545	-0.1	-10.1%
Transit	Billions of 1999 Dollars	--	0.276	1.728	1.5	526.1%
Total Regional	Billions of 1999 Dollars	--	13.469	12.253	-1.2	-9.0%
Sub-Regional		--				
On-Site	Billions of 1999 Dollars	--	11.256	8.218	-3.0	-27.0%
Roads	Billions of 1999 Dollars	--	2.706	1.916	-0.8	-29.2%
Water	Billions of 1999 Dollars	--	1.429	1.030	-0.4	-27.9%
Other	Billions of 1999 Dollars	--	7.121	5.272	-1.8	-26.0%
Off-Site	Billions of 1999 Dollars	--	1.736	1.461	-0.3	-15.8%
Roads	Billions of 1999 Dollars	--	0.329	0.260	-0.1	-21.0%
Water	Billions of 1999 Dollars	--	0.594	0.512	-0.1	-13.8%
Other	Billions of 1999 Dollars	--	0.813	0.689	-0.1	-15.3%
Total Sub-Regional	Billions of 1999 Dollars	--	12.992	9.679	-3.3	-25.5%
Total Regional and Sub-Regional	Billions of 1999 Dollars	--	26.461	21.932	-4.5	-17.1%
Total Roads	Billions of 1999 Dollars	--	15.622	12.156	-3.5	-22.2%
Total Water	Billions of 1999 Dollars	--	2.629	2.087	-0.5	-20.6%
Total Transit	Billions of 1999 Dollars	--	0.276	1.728	1.5	526.1%
Total Other	Billions of 1999 Dollars	--	7.934	5.961	-2.0	-24.9%

* Congestion, transit, and mobile emission measures are for metro counties only.

* *Represents the base year for modeling purposes and varies from 1995-1998 among measures.

Strategy Analysis: Genesis of the Quality Growth Strategy

A. Process for Deriving the Strategies

Overview
Envision Utah's goal is to develop and implement a Quality Growth Strategy – a vision to protect Utah's environment, economic strength and quality of life for generations to come. Envision Utah's second phase (1999) has been dedicated to the development and refinement of a draft Quality Growth Strategy and the design of realistic steps for its implementation.

The Quality Growth Strategy includes goals and stategies that have been developed and refined through a broadbased and hands on public process. The process was designed to involve all residents, as well as targeted towards elected officials, key stakeholders, and those most knowledable about planning issues in the area. In all, the following mechanisms helped garner the key public input required to develop the Quality Growth Strategy:

- 570,000 questionnaires were distributed to residents;

- 100 community meetings were held involving approximately 2,000 residents;

- Three stakeholder meetings were hosted involving 240 attendees;

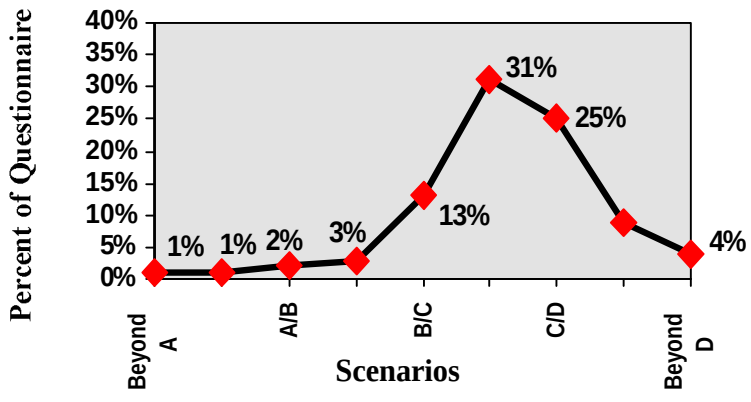
- Several Envision Utah Partner, Steering Committee, and Scenario Committee meetings were held involving a cross-section of about 190 community leaders (including many elected officials); and,

- A local area planners meeting was held involving 30 planners employed by cities and counties within the study area.

This extensive public involvment provided feedback on the original scenarios (A, B, C and D); insight on the development of meaningful, workable and effective goals and strategies; assistance in developing a concept map for modeling purposes; and feedback on the analysis of the Quality Growth Strategy. The following is a more detailed description of this process.

Compilation of Public Feedback
In January 1999, more than 570,000 questionnaires were distributed to educate the

Figure 7: Envision Utah Public Feedback Results for the Greater Wasatch Area



Source: Envision Utah

public and solicit feedback for the development of a Quality Growth Strategy for the Greater Wasatch Area. Envision Utah hired Wirthlin Worldwide to compile and analyze the results of the nearly 17,500 surveys received from Greater Wasatch Area residents. Input collected from nearly 2,000 residents who attended one of 50 town meetings was also reflected in the results of the survey data. The survey's primary objective was to determine how area residents evaluated the four growth scenarios presented by Envision Utah.

The results showed that the most important growth-related topic among residents was air quality, rated as the 1st or 2nd most important issue by 52% of residents. Total water demand, transportation choices, and the amount of new and agricultural land consumed rounded out the top four most important growth related topics. Scenario C, a growth strategy accommodating new growth by increasing the proportion of new development devoted to infill and redevelopment, as well as focusing the development of new lands into walkable development types, was overwhelmingly perceived as the best strategy for the Greater Wasatch Area.

Partnership Review and Strategy Development

In March 1999, Envision Utah presented the survey results to the Partnership and media. The Partnership, which consists of 113 partners and 17 special advisors, reviewed the four scenarios and key model outputs. In addition, citizen reactions to the alternative scenarios were synthesized prior to the workshop and presented to the partners in a concise, user-friendly format. Information included the results of public surveys, town meetings, and online reactions to the four scenarios. Finally, the Partners discussed the work plan for the year and developed a list of key issues to initiate the development of the Quality Growth Strategy.

In April 1999, Partners and a variety of elected officials were asked to evaluate a list of possible growth strategies to help move the Greater Wasatch Area toward what area residents had indicated as their preference. Working in tables of 10 in their respective regions, the approximately 75 participants were asked to review goals of the Envision Utah Quality Growth Strategy and a list of draft implementation strategies compiled by Envision Utah staff and consultants. This list deliberately included a wide range of strategies, from the draconian and brutally effective, to the soft and marginally effective. During this event, each table analyzed, edited and ranked the strategies based on scope and feasibility. Comments and input from all workshop tables were compiled and analyzed to elicit significant input and trends from workshop participants.

Public Review of Draft Strategies

After modification of the draft strategies based on input given by the Partnership, Envision Utah

took the revised set of draft strategies to the general public. Envision Utah hosted a series of 50 community meetings, inviting residents to review and discuss the issues presented by the

set of strategies and the feasibility of adopting them in their own communities. The input gathered at these meetings helped to further refine the draft strategies.

Stakeholder Review

Envision Utah looked to key stakeholders (planning officials, elected officials, developers, business leaders, conservationists, and representatives of church and citizen groups) to provide realistic ideas for implementation for their local communities.

Three sub-regional stakeholder workshops were held to gather more input for the development of draft quality growth strategies. The approximately 240 participants were asked to work within detailed subregions of the Greater Wasatch Area to allocate land use icons within a series of walkable and non-walkable development types. They were also asked to review how current municipal plans would accommodate future growth. After completing these tasks, participants extracted the most important points from their maps to develop a more basic conceptual framework map. Then, each group developed a list of general polices and implementation strategies to guide action toward the conceptual land use framework.

By analyzing the maps generated through this exercise, analysts were able to see what development mixture participants would favor in their own communities and where they would place new villages and towns. Also, special consideration was given to input generated from actual residents of a particular community along

the map. These workshops provided input for the refinement of the Quality Growth Strategy and important guidance for the development of map layers.

Scenarios and Steering Committee Evaluation

The Scenarios Committee, a group of 32 technical experts from the public and private sectors, and the Steering Committee, a representative stakeholder group of 25 people who oversee the work of Envision Utah, both

undertook a careful evaluation of the goals and draft strategies. Scenarios Committee members were specifically asked to assess strategies related to their areas of expertise for effectiveness and technical feasibility. The Envision Utah Steering Committee then reviewed all of the input given up to that time on the draft strategies. They considered input from the original Partnership meeting, comments from the public and stakeholder meetings, and the assessments of the Scenarios Committee members to decide what strategies should comprise the Envision Utah Quality Growth Strategy. Strategies were selected based on political feasibility, public acceptance, and technical effectiveness.

Planners "Reality Check"
Thirty regional and municipal planners from around the Greater Wasatch Area met with the consultants to review and analyze public input and the newly revised draft Quality Growth Strategy to ensure consistency and accuracy. They gave their input and advice to further refine the QGS.

Steering Committee Review
In August, the Steering Committee met to analyze the public input gathered over the past six months, the housing demand analysis and an evaluation conducted by the Utah Foundation on the Envision Utah Process.[3] Members gave their final input before the strategy was sent to the QGET Technical Committee for modeling. The Steering Committee met once again in September to review and make recommendations for the content and language included in the draft Quality Growth Strategy.

[3]See *Envision Utah: An Independent Analysis of the Envision Utah Process*, Utah Foundation, August 1999.

B. Housing Demand Analysis

Overview

In June 1999, Envision Utah hired a consulting team to analyze housing market conditions throughout the Greater Wasatch Area. A competitive bid process resulted in the selection of ECO Northwest, an economics firm based in Oregon, and Free & Associates, a Utah appraisal firm. In September 1999, the consultants completed the report titled, *Greater Wasatch Area Housing Analysis*.[4]

The housing study was an instrumental step in creating the Quality Growth Strategy. The analysis added a significant degree of realism to the process by enabling the Quality Growth Strategy to address the goals identified by the partnership and the public in a way that is responsive to the existing and projected housing market.

The main objectives of the study were to:

- Determine the components of existing demand and assess how that demand is currently being met; and
- Determine the anticipated components of future demand and identify barriers that may prevent that demand from being met.

These objectives were met within the context of a long-run housing perspective. This is, short-run cycles are downplayed and the focus is long-run trends.

Findings

The consultants' report addresses a variety of demographic and social factors, tying them to its assessment of current market conditions and its projections of long term housing trends. The report examines trends that will affect the future housing market in the Greater Wasatch Area. The analysis leads to the development of two different simulations of the distribution of housing in 2020: a baseline simulation based on the continuation of trends in the 1990s, and an alternative simulation that reflects expectations about the way housing demand will shift in response to projected demographic shifts in the Greater Wasatch Area.

In both simulations, an average of almost 20,000 housing units per year are needed between now and 2020 to keep up with the forecasted growth in households. In the baseline simulation, over

Table 2: Distribution of housing by type, actual and predicted, Greater Wasatch Area

	Actual			Predicted			
				Base Simulation		Alternative Simulation	
Housing Type	**1990 Total**	**Change 1990-1999**	**1999 Total**	**Change 2000-2020**	**2020 Total**	**Change 2000-2020**	**2020 Total**
Single Family	66%	73%	67%	74%	70%	59%	64%
Multiple Family	29%	25%	29%	24%	27%	40%	33%
Mobile/Manuf	5%	2%	4%	2%	3%	1%	3%

Sources: U.S. Bureau of the Census (1990)
Bureau of Economic and Business Research (1990-1999)ECO Northwest (2000-2020, 2030)

[4]This report is available on the Envision Utah website at http://www.envisionutah.org

70% of new housing is single-family. In the alternative simulation, the sinfgle-family share drops to about 60%, with a corresponding increase in the multi-family share; and the number of smaller lot (less than 5,000 square foot) single-family units increases by an average of about 500 units per year.

The more detailed breakdowns of housing type by county provided a market driven check on the assumptions used to allocate population to different development types in the Quality Growth Strategy. The conclusion of those working on the development of the Quality Growth Strategy is that its allocations are consistent with the Alternative Siimulation of housing types.

The report also identifies and analyzes barriers that may affect the supply and affordability of housing for local residents. Among the barriers identified are: cultural perspectives, misperceptions of abundant land resources, lack of consistent growth, lack of education regarding sustainable planning practices, land ownership patterns, and development industry restraints.

C. Developing a Concept Map

Spatial Analysis and Development of the Quality Growth Strategy

The concept map provides a digital version of a quality growth scenario that can be analyzed by technical experts. Its data layers contain information on where growth will and will not occur and the nature of this growth (population, employment, and housing distribution). Data layers were analyzed to produce an estimate of available and developable land in the region. The Quality Growth Strategy, which emerged out of the public outreach process described earlier, was then applied to test its impact on traffic, air quality, infrastructure costs and water demand.

Map Overlays

Committed - Constrained Mask

Using data developed by QGET and the University of Utah, a coverage to use as a mask in design development was developed. It consisted of three parts:

Developed Land

The University of Utah used SPOT satellite data merged with LANDSAT multi-spectral data to develop a built/not built grid. This was further refined by QGET. QGET completed some original geocoding based on employment records, as well as seeking review from local government of the built and non-built area.

Committed Land

This component consists of public ownership including Federal, State, County, City and schools. Though public lands are occasionally sold for development and pursuing federal land trades is one of the strategies, for the purposes of modeling all public lands are left undeveloped.

Constrained Land

This category includes wetlands, slopes exceeding 25%, floodplain and riparian buffers around streams and lakes. Some of these lands will likely be developed, but in this work they are excluded from the buildable lands inventory.

Stream and Lake Buffers

Lakes were buffered 300 meters and this mask was added to the constraints mask. In areas where other constraints (wetlands or floodplain) were present beyond this buffer they became additions to the buffer. Perennial streams were buffered 200 meters from the centerline with the Jordan River buffered 400 meters. All other streams were converted directly to grids, giving them an effective buffer of 15 meters on either side from the centerline.

Redevelopment and Infill

A separate process determined the potential for redevelopment in the region. Since this activity occurs on already developed land the cells considered likely candidates for re-use were eliminated from the mask, and thus added back to the land supply.

These categories were assembled into a grid representing land that is not available for development. The inverse of this grid represents the available land supply for development of the Quality Growth Strategy.

Redevelopment

The methodology relied on the total assessed value of parcels generated by QGET. Using the focal mean function, which averages values within a given distance, these totals were converted to mean value within 300 meters. The original assessed values were then divided by

the mean value to generate a grid representing the percentage of the mean surrounding value. Property values below the mean surrounding value were considered subjects for potential redevelopment. Only those grid cells that were 75% or less of the mean surrounding value for redevelopment coverage were included. Redevelopment was confined to walkable design types (Downtown, Town and Village) where the potential of the underlying zoning might offset demolition and development costs. Since there are many other factors to be taken into consideration, it is much trickier to evaluate industrial and residential land using this methodology.

A visual inspection of the results made intuitive sense and replicated findings in the Portland area (the only other comparable area QGET had data for). The Portland analysis showed surface parking had the lowest value when compared with surrounding development. Older buildings of 1-2 stories were the next tier of potential redevelopment. The majority of surface parking in Portland has been developed over the past 7-8 years. In addition, a number of smaller buildings have been replaced with new offices and mixed-use buildings.

This methodology can be adjusted to accommodate historic districts that might not otherwise fare well in the context of newer buildings. The results should also be continually checked to assure that publicly owned or tax-exempt properties are masked from redevelopment potential.

Infill

Using the population grid, developed by QGET from windshield surveys throughout the region, the general plans were cross-checked to estimate potential development given the underlying plan. Infill was allowed to occur where density implied parcels of 2 acres or more. Land with higher densities was added to the mask of developed land. Implementation of infill did not replace existing buildings (derived from the built/not built layer), but the remaining cells were developed at the densities in the development type. This methodology was only implemented in residential zones (Residential Subdivision and Large Lot). Developed land at any density was retained outside development types.

Merging of Quality Growth Strategy and Mask

The Quality Growth Strategy was populated using a 150-meter polygon to approximate refinements to the design developed through the workshop process. Population and employment were balanced to totals calculated for the portions of counties within the study area. In addition, housing types were balanced to match, as closely as possible, the types projected by the housing demand study commissioned by Envision Utah.

The design was then converted to a grid and then merged with the mask. This allowed development only in vacant, buildable land, or on land that is likely to redevelop. Each 30-meter grid cell, depending on the development type, adds population and employment to the scenario.

Balancing the Quality Growth Strategy with Population and Housing Forecasts

Following the first iteration of the Quality Growth Strategy, data was output to a spreadsheet that compared the growth represented in the Strategy with QGET forecasts for population for the 10 county area, and with housing type forecasts prepared by ECO Northwest. An iterative process was used to modify the design so that the growth represented

on the Strategy matched the population and employment forecasts, and the housing types represented matched the housing need forecasts by ECO Northwest. Dozens of iterations were required, each one making small-scale changes in the growth plan, and repeated iterations brought the Strategy data to within 1% of the two forecasts.

Evaluation of the Quality Growth Strategy
Population and employment totals from the Quality Growth Strategy were then exported for further analysis by QGET.

Development of Advocacy Layers
Development of the Quality Growth Strategy was organized into complementary layers of the decision-making process. These sets of data demonstrated the connections between sets of decisions addressed in crafting the Quality Growth Strategy.

Infrastructure & Centers and Corridors
Developing centers and corridors maximizes the effectiveness of existing and proposed infrastructure

New Areas & Redevelopment
Expansion onto farmland and other vacant land at the edge of the urban area can be minimized if redevelopment of underutilized or declining urban areas is encouraged.

The Quality Growth Strategy includes some development on vacant land but is offset by infill and redevelopment within the existing urban area.

Open Space & Physical Constraints
The existing open space system, including public ownership, schools, parks and trails is complemented by protection of environmentally constrained lands.

Strategy Analysis: Technical Disclosure

A. Economic and Demographic Control Totals

The Governor's Office of Planning and Budget is responsible for providing long-run economic and demographic projections for purposes of state planning. These projections are produced at the state and county levels. The 1997 baseline projections form the basis of the Baseline and the Envision Utah Quality Growth Strategy.[5]

Projections and Control Totals: Greater Wasatch Area

Ten-County Area - The QGET study area for the Baseline and the Quality Growth Strategy is the full ten-county area of the Greater Wasatch Area. This area includes the counties inclusive of Box Elder to the north and Juab to the south with Tooele on the west and Summit on the eastern side. The use of the full ten-county area follows the standard for which economic and demographic figures are produced. Projections for this area indicate that population will grow from 1,687,124 to 2,695,273 from 1997 to 2020. The number of households are projected to grow from 549,889 to 952,910. Non-farm jobs will grow from 841,581 to 1,368,024.

Urban Core - The ten-county area is not the only area for which control totals were prepared. The Greater Wasatch Area also includes the Urban Core which stretches from Brigham City to Nephi, and Grantsville to Kamas. The difference between the two areas is that the ten-county area includes all parts whereas the Urban Core includes only portions of Box Elder, Tooele, Utah and Juab counties. The Urban Core includes all population that will be immediately effected in the Envision Utah time horizon of 2020 by urbanization. Several communities within the ten-county area are small enough and located on the periphery of these counties and will not be impacted as heavily by the trend of urban growth and are therefore excluded from the detailed Quality Growth Strategy modeling. These communities maintain the same QGET empirical measurements as projected under the Baseline.

Though the full ten-county area is the QGET study area, the Urban Core is where the main thrust of the QGET modeling is directed. To ensure quality and consistency of the QGET modeling, population, households and employment control totals were prepared for this geography and strictly adhered to as model inputs. Because the county is the smallest geography for which structural projections are provided, estimations by regional and state analysts were employed to develop control totals for the Urban Core. The control totals were based on the separation of incremental county populations into modeled and non-modeled population. A ratio was then taken and applied to the base and projected population, households and employment numbers. This process resulted in a base population for the Urban Core of 1,667,890 and a projected population of 2,666,814. Households are projected to grow

[5]Note: New economic and demographic projections were released in January 2000. These projections will gradually be incorporated into new QGET work. The new projections can be accessed at: http://www.qget.state.ut.us/projections

from 543,644 to 943,284. Non-farm jobs for this area are projected to grow from 833,305 to 1,355,620.

Fregonese Calthorpe and Associates controlled to the county projections for households but only modeled the households within the Urban Core. Modeled households were then summarized by county or other geography and if needed converted to population to be used by transportation, air quality, water and infrastructure modelers to analyze the Quality Growth Strategy.

Technicalities

Some technicalities were dealt with within the Urban Core to ensure comparability of modeled results between models, scenarios and control areas. The first is the differences in model domain beyond the Urban Core. The domain of both the transportation and air quality models are fixed and differ from one another. The air quality domain is slightly smaller than the red rectangle shown as the Urban Core (see map of Greater Wasatch Area). Though it differs in size, the population it covers is consistent with that of the Urban Core and is therefore a technicality that does not compromise its results with those of other models.

The traffic models domain is significantly smaller than that of the Urban Core though it still captures most of the population. This is not to say that the transportation modelers left out a segment of the population. Rather, they used off-model techniques to incorporate the full study area. Demographic and employment information was then also prepared at small geographies known as Traffic Analysis Zones. The aggregation of this information does not constitute a new control area in which the population must be consistent in all scenarios. It is simply an additional level of geography in which information was aggregated.

The last technicality deals with controls for employment. Employment was controlled at both the ten-county and the Urban Core areas. Unlike population and households, employment was not controlled at the county level. In the Quality Growth Strategy development takes the form of mixed-use housing. One element of mixed-use housing is the location of housing and employment in close proximity to one another. This is not to mean that large employment centers will cease to exist but that local officials and developers will seek overall to develop in this mixed-use style in the Quality Growth Strategy. Though the employment numbers are not exact at the county level they are fairly close to the county projections.

B. Transportation

The transportation strategy includes projected changes in transportation infrastructure, as well as non-capital policies that will contribute to achieving the goals of the overall strategy. The transportation strategy is also affected by the distribution of population and employment made as part of the Quality Growth Strategy. This section describes the basic characteristics of the transportation strategy and the analysis of the projected performance of the strategy in 2020.

Development of the transportation strategy followed from the analysis of the alternative growth scenarios. The strategy was designed to refine the previously developed alternatives by incorporating the desirable features of each, providing additional detail, and adding additional features identified in the analysis or through public discussion. The strategy includes specific regional transit and highway improvements, policies that will promote more efficient use of the system, and more efficient overall development.

Strategy Development

The alternative scenarios developed and analyzed during the previous phase covered a range of development patterns and transportation infrastructure combinations. The result of the technical analysis and the public input on the alternatives was that the alternatives that leaned towards slightly more concentrated development and placed more emphasis on walking and public transit were preferred.

The assumed distribution of population and employment in the Quality Growth Strategy reflected a change from the alternative scenarios. At a broad county-by-county level the assumption was that the distribution of population and employment will be the same as the baseline. The baseline scenario was less concentrated than two of the three alternative scenarios so this decision is somewhat counter to the analysis and public input. However, the conclusion was that the voluntary nature of the growth strategy would not change the population and economic growth of counties. The Strategy did, however, assume that the patterns of development within the individual counties would accommodate the growth with less land consumption. Further, much of the new development would be more walkable and transit-oriented. Finally, the development patterns were assumed to contain more mixed-use development.

The capital improvements assumed in the strategy reflect an increased emphasis on public transit and a reduced emphasis on new highway capacity. While the emphasis on public transportation has increased, the Strategy recognizes that maintenance of the existing road network and necessary new traffic carrying capacity will require significant capital expenditures on streets and highways as well. In fact the capital expenditures assumed for highways are approximately 80% of the assumed regional capital expenditures. However, the Quality Growth Strategy assumes over $2 billion less in regional highway investment than the Baseline. At the same time the strategy includes over $1.5 billion more in fixed guideway transit.

A comparison to the alternative scenarios highlights a few key elements of the Strategy. The county-by-county population and employment distribution resembles the Baseline while the within county growth patterns are more like Alternative C. The transit investment levels are between Alternatives C and D and the highway investments are similar to existing long range plans. As a result one would expect

performance to fall generally in the same range as the alternative scenarios.

Strategy Evaluation

The evaluation of the Strategy focused on similar measures as were used in the scenario evaluation. The measures used were: total vehicle miles of travel, vehicle miles of travel per capita, average peak speeds, daily transit trips, and transit share of daily work trips. The analysis of total VMT and per capita VMT was done for the three urbanized areas combined and the 10 county Greater Wasatch Area (GWA). The GWA adds considerable area but represents less than 25% of the total VMT.

The tools used for the analysis were the same as those used for the scenario analysis with some small variations. The metropolitan area or urbanized area was analyzed using travel demand models while the estimates for the remainder of the GWA were developed using growth rates and expert judgment. The travel demand models used were those in use for the urban transportation process in the three urbanized areas. The majority of the parameters in the models were developed using data collected in from a home interview survey conducted in 1993. As a check the models are validated against actual traffic counts and transit boardings.

The variations from the scenario analysis used included more detailed transit networks. The more detailed networks not only allowed the system to be optimized but it also results in a more reliable estimate of future transit ridership. The other variation was to estimate walk and bike use based on a more detailed evaluation of the characteristics of the developed area as opposed to the average for traffic analysis zones that include developed and undeveloped area. The end result is slightly higher estimates of walk and bike and almost certainly more reliable estimates.

The models represent the best methods available at this time for predicting the response of the transportation to growth, changes in transportation investments, and changes in development patterns. Models, however, will always have limitations and never be capable of predicting all of the possible consequences of any action. As an example, the Strategy tries to create neighborhoods that provide for more of the needs of a household within walking distance and make walking more convenient. The models include walking and biking as options, but they are based on behavior along the Wasatch Front today. Since there are few of the kinds of neighborhoods being proposed, the models may over estimate or under estimate the response to these changes.

Table 3: Results of the Transportation Analysis

Performance Measure	Area	Current Conditions	Baseline	Quality Growth Strategy
VMT per day (miles)	GWA	40.7 million	79.2 million	76.8 million
VMT per capita per day (mi)	GWA	25.1	29.3	28.3
VMT per day (miles)	Urbanized	33.4 million	60.4 million	57.4 million
VMT per capita per day (mi)	Urbanized	24.1	26.0	24.8
Average Peak Speeds (mph)	Urbanized	25.7	20.0	22.5
Average Trip Time (min)	Urbanized	18.5	23.2	22
Total Transit Trips	Urbanized	54,000	120,000	165,000
Transit Share of Work Trips	Urbanized	3%	3%	5%

Results of the Analysis

Table 3 shows the key characteristics for the Baseline and the Quality Growth Strategy. Most of the changes between the Baseline and the Quality Growth Strategy are not dramatic. As the area grows the demand for transportation will grow and the means people use to get around will not change drastically. The exception to the trend is the transit ridership. The analysis indicates that with an investment in public transit will come a significant increase in ridership. It is also important to recognize that what seems like a small change can be significant. A 5% reduction in urban VMT will pay dividends in shorter peak times and reduced congestion that will exceed 5%.

Examining the individual changes helps to understand the Strategy more clearly. The Strategy sets out to reduce dependence on vehicle travel and the analysis suggests it will have some success. The Strategy includes a significant investment in major transit investments as well as attempting to ensure that population will have access to these investments by modest changes that will concentrate development around transit changes. The analysis assumed that most of the major transit investments will be light rail or commuter rail for ridership and cost estimating purposes, but the analysis does not pretend to be the kind of detailed comparison that will need to be done to decide the appropriate technology for each piece of the system.

The Strategy assumes that $1.7 billion will be spent on capital improvements to public transportation over the 20 year period. This is ambitious, but possible. With $1.7 billion it is possible to expand the existing rail system by 40-50 miles and to implement a major inter-regional investment from Ogden to Provo. In addition, the bus system can continue to expand to keep pace with growth.

The result of this expansion is that the share of work trips using public transportation can be expected to grow from 3% to 5%. The share of work trips may be the best measure of the impact of transit on congestion because work trips are concentrated in the peak hours and transit use will be higher for the larger concentrations of employment. As a result, the impact felt from the improvement in public transit will be greater than might be expected if one only looked at the change in the number of riders. The change in the number of riders expected under the Strategy is significant. Transit can be expected to carry three times as many people as it does today. The increase from the baseline of 45,000 is almost as many trips as are made on public transportation today.

Both the Baseline and the Strategy will result in slower peak speeds in 2020 than exists today. The drop in peak speeds of 2 miles per hour is not large, but it is important to recognize that neither the Baseline nor the Strategy will have less congestion than we have today. The average trip time for the Strategy will be approximately 5% less that the Baseline. The reduction in average trip time results from shorter trip lengths and faster speeds.

The final measures relate to the total amount of travel. The travel models estimate total vehicle miles of travel (VMT) for an average weekday in 2020. In 1995 there were approximately 33 million miles driven daily in the area covered by the models and 40 million in the 10 county Greater Wasatch Area (GWA). By 2020 the models estimate that the number will grow to over 60 million per day and when the area outside the models is added it climbs to almost 80 million miles. The increase is due to a 60% increase in the number of people and a 10% increase in the number of miles driven per person. The VMT per capita grows from 24 miles per person per day to 26 miles per person

per day. The Strategy reduces the growth in VMT per capita from 2 miles to 0.8 miles. The result is 3 million less miles driven per day.

It important to note that the VMT estimates include an off-model adjustment applied to the Strategy. The Strategy includes a policy to promote telecommuting and an adjustment was made to the VMT from a modeled estimate of 58.2 million miles per day to 57.4 million miles. The reduction represents a reduction in work trip travel of 7-8%. Given the current growth in telecommuting such an increase is plausible.

C. Air Quality

Background

One year ago, as part of the QGET analysis of alternative growth strategies, the Utah Division of Air Quality developed a simplified air quality model to analyze the effects of different growth scenarios on air quality in the Greater Wasatch Area. A set of evaluation metrics were used to measure three separate but related aspects of a region's air quality: Total emissions released into the airshed, the distribution of those emissions, and the coincidence of population and pollution. The details of the first QGET analysis as well as an explanation of the model, the assumptions upon which it is based, including some of its limitations, and a discussion of the evaluation metrics can be found in the previous QGET publication: *Scenario Analysis*, March 1999.

The current QGET analysis of air quality is a comparison of the Baseline scenario and the Quality Growth Strategy or QGS. The same modeling technique was used to compare these two scenarios as was used to compare the four scenarios in the initial analysis. There are four general areas of consideration with respect to factors influencing model results. These are discussed below.

Meteorological

The first consideration is the meteorological component, which represent the surface winds moving the air pollutants during a hypothetical day in the future. These winds were developed from periods in the past when the air pollutants being studied--carbon monoxide (CO), fine particulates (PM10) and ozone (O3)--were at high levels in the study area. The meteorology remains the same in this analysis as it did for the previous four scenarios. Wind fields representing winter conditions are used for CO and PM10, and those for summer conditions are used for O3.

Population Distribution

The regional population for the Greater Wasatch Area was held constant between the two scenarios. Although the population of each county remains constant, there is some variation in the spatial distribution within each county between the two scenarios. The implications of population size and distribution affect the air quality modeling in the following ways. Area sources are one of the three main categories of air pollution. Area source emissions are calculated according to population size, so the overall emissions from area sources will remain nearly constant within each county (see Table 4). What will change is how those emissions will be injected into the model on an hour-by-hour basis during the modeling. In addition, evaluation metrics two and three will be influenced by the population distribution. Metric two measures the concentration of emissions in localized areas and metric three measures the coincidence of population and pollution. Because the area source emissions which are significant contributors to O3 and CO emissions are linked to population estimates, the relative concentration of population in the four urbanized counties will cause metric two to remain fairly constant.

Point Source

Point source emissions, another major category of pollution, also remain constant between the two scenarios. These industries are defined by some threshold of tons of pollutant per year emitted from the source. In the original analysis comparing the four scenarios, the largest industrial sources were left out of the analysis. For this comparison large industrial sources are

Table 4. Relationship Between Population and Area Source Emissions

	Population		Nox + VOC (ozone) Emissions t/d		CO		PMIO	
County	**Baseline**	**QGS**	**Baseline**	**QGS**	**Baseline**	**QGS**	**Baseline**	**QGS**
Davis	355,041	355,041	44.83	44.74	97.87	97.67	3.2	3.19
Salt Lake	1,301,094	1,301,094	163.6	164.58	324.77	326.72	9.57	9.63
Utah	535,047	535,047	64.46	63.82	145.69	144.23	6.68	6.62
Weber	284,172	284,172	28.98	28.75	64.4	63.88	2.66	2.64
sum	2,475,354	2,475,354						

Table 5: Comparison of VMT and Mobile Emissions for Each Scenario

	Total Vmt		Nox + VOC (ozone) Emissions t/d		CO		PM10		Total emissions	
County	**Baseline**	**QGS**	**Baseline**	**QGS**	**Baseline**	**QGS**	**Baseline**	**QGS**	**Baseline**	**QGS**
Davis	8,995,016	8,170,537	28.15	26.09	132.76	120.93	21.59	18.87	182.5	164.0
Salt Lake	33,948,631	31,012,104	112.05	102.74	564.87	500.3	41.65	37.66	718.56	633.3
Utah	10,510,034	12,003,681	34.93	41.44	92.56	119.17	24.26	26.13	151.75	184.6
Weber	6,957,089	6,197,621	26.05	23.49	123.47	110.86	9.35	8.42	158.87	141.1
sum	60,370,770	57,383,942	201.18	193.76	913.66	851.26	96.84	91.08	1,211.68	1,123.0
	Difference	**5%**	**Difference**	**4%**	**Difference**	**7%**	**Difference**	**6%**	**Difference**	**7%**

counted and do not change their emission rates or location in either scenario. Emissions from smaller point sources are changed in location based upon the amount of land in a grid cell which is classified as industrial/office.

Mobile Source

Mobile source emissions from automobiles is the final emission source category, and the pollution source which varies the most between the scenarios, based on the transportation demand modeling. The major changes in this category occur in the four urbanized counties as displayed in Table 5.

From the discussion above it is clear that the only changes in absolute emissions which are input to the model are in the mobile source category. Overall changes in mobile emissions in the four county urbanized area decrease from 4% to 7%, with a total decrease in emissions of 7%. Total VMT in the four counties decreases by 5%. Another interesting comparison between Tables 4 and 5 is that population remains constant within each county while VMT drops in all counties except Utah County where it increases by 14% from the Baseline to the Strategy. This change is based on the transportation demand modeling.

Quality Growth Strategy Analysis

The air quality model was run for the three pollutants for each scenario as was done a year ago in the original, multi-scenario comparison. There were two differences between this analysis and the original. In the previous exercise large industrial sources of air pollution were left out of the model. For this analysis these large point source emissions are included in the model with no change in either location or emission rates between scenarios. The second change has to do with the method used to calculate the third metric, measuring the coincidence of population and pollution. Research in the last year done by a graduate student in mathematics indicated that a simpler

and more direct approach to calculating this metric would be preferable to the prior method. The current method simply multiplies the population density by the daily average emissions density in each cell, then sums those values for every cell in the modeling domain. When that final sum is compared between the two scenarios, the one with the lowest value has the least coincidence of population and pollution for a given pollutant.

As described in the preceding section, the inputs for this analysis did not vary a great deal between the two scenarios. This was true among all four of the major components of the modeling system. The meteorology remains constant because one is searching for the differences which occur from a change in emission patterns as a result of urban planning policies.

Given the constraints and limitations of projecting emissions 20 years into the future, the estimated air pollution for each major category, with the exception of mobile sources, did not vary appreciably between the scenarios either. Industrial source pollution remained constant, area source emissions changed in each county in step with the change in population for each scenario, and mobile emissions varied in the four urban counties as a result of changes in total vehicle miles traveled and changes in average speed. As shown in Table 6, the two metrics that measure the distribution of pollution show little contrast. This follows from the similarity in population distribution between the scenarios because the public process used to design the scenarios resulted in strategies that kept a very similar population distribution within each county as the Baseline.

Conclusions

The lowest value for each metric indicates the best performance or best overall air quality. Table 6 shows that the numbers in each individual category are very close. This occurs because the techniques for estimating future emissions can only be based on general trends and are not always capable of measuring small increments of change. Table 6 shows that the Strategy has less overall emissions for all three pollutants. It also shows, in metric three, that there is a greater coincidence of population and pollution in the Strategy even though total pollution levels are lower. One might expect that during the summer months, when ozone is a problem, stronger winds and the lack of a temperature inversion would clear more of the pollution away from the populated areas. Although that may happen to some degree, in the model simulation not enough of the pollutants are dispersed to overcome the increased population density in the urban areas. The end result is that the Baseline and Strategy have very similar air quality characteristics with the Baseline exhibiting a slightly preferred distribution of emissions, but the Strategy showing lower emissions overall.

Table 6: Evaluation Metrics Comparing the Two Scenarios

	CO	PM	O3	
Emissions T/D				**Total**
Baseline	1,872.40	167.90	593.80	2,634.10
Strategy	1,808.10	163.80	586.50	2,558.40
Concentration Measure				**Average**
Baseline	.85	.81	.68	.78
Strategy	.85	.82	.69	.79
Population/Pollution				**Average**
Baseline	2.33	1.70	3.30	2.44
Strategy	2.44	1.78	3.38	2.53

Compliance with national air quality standards requires strategies to reduce air pollution from as many different directions as is economically feasible. In addition, failure to comply with these national standards is usually only a problem in the most urbanized counties. A reduction in automobile emissions of 7% within the urbanized area (such as that estimated for the Strategy) could be a significant control strategy for reducing air pollution in the future. From this perspective, growth planning that reduces the necessity of automobile travel can be an important tool for air quality regulators.

D. Water

The Wasatch Front Water Demand/Supply Model was used to project water demands for both the baseline and quality growth scenario.[6] Separate calculations are made for residential uses and for commercial/industrial uses. Residential demand is calculated as a function of persons per household, lot size, assessed value of property, soil type, and season of the year. Industrial and commercial demand is calculated as a function of employment.

These water demand functions are combined with the population distribution, water pressure system zones, and changing land use categories to yield a forecast of water demand.

The Quality Growth Scenario assumes a 12.5% reduction by 2020 in per capita water use because of low flow plumbing, gradual increases in xeriscaping, and price increases. In contrast, the Baseline Scenario assumes a 6.25% reduction by 2020 in per capita water use. Real water rate assumptions are constant among the two scenarios. Both scenarios assume a 10% increase in real water rates by 2020.

The Quality Growth Strategy is an excellent approach to achieve the 12.5% reduction/conservation of water consumption through education, incentives and/or mandates.

Since the price assumption is the same in both scenarios, per capita water use varies among the scenarios because of changes in land use and conservation. This includes differences in the lot size, allocation of population and employment, and conservation in each scenario.

Water Demand

Water demand is the acre feet of residential, commercial, industrial, and secondary water required to meet the needs of a constant regional population within each scenario. Total water demand includes water used by large, self-supplying industrial facilities such as Kennecott Copper; per capita calculations exclude large self-supplied users. The amount of water demanded varies primarily because of differences in the amount of outdoor watering.

Per Capita Water Use

Current per capita residential, commercial, industrial, and secondary water use in the Greater Wasatch Area is approximately 319 gallons per day. Precipitation is a primary factor influencing water consumption and Utah presently ranks as the second highest state in per capita water consumption. The Baseline scenario per capita use is 298 gallons per person per day. The Quality Growth scenario per capita use is 267 gallons per capita per day. Under the Quality Growth Strategy, Utah would still have high per capita water use relative to many western states, based on 1995 rankings.

Water Development

Both scenarios require varying levels of state and regional infrastructure investment to supply the needed water. Both scenarios include the completion of the Central Utah Project, as currently envisioned. Moreover, both scenarios envision some development of the Bear River, but the Quality Growth Strategy postpones treatment of Utah Lake water until after 2020.

[6]For more information on this model see, *Wasatch Front Water Demand/Supply Model*, Utah State University, and Utah Division of Water Resources. September 1993.

E. Infrastructure Cost Assessment

Background
The QGET Technical Committee, under the direction of the Governor's Office of Planning and Budget, developed a set of tools to provide cost estimates of infrastructure required under different land use scenarios. This set of tools, the Infrastructure Cost Assessment Model, was developed through the cross-disciplinary efforts of engineers, controllers, economists and planners. Major contributing agencies include:

- Division of Water Resources
- Division of Water Quality
- Mountainland Association of Government
- Wasatch Front Regional Council
- Central Utah Water Conservancy District
- Salt Lake County Water Conservancy District
- Psomas Engineering (under contract with Division of Water Resources)

In addition to these contributors, staff from the Governor's Office of Planning and Budget sought direction and input from public works directors from 15 cities, four additional special service districts, two other engineering firms, and the Governor's Council on Economic Advisors. Some of the assessment procedures also benefited from the Utah League of Cities and Towns' study of municipal impact fees.

The Infrastructure Cost Assessment Model continues to be a work in progress. The estimates provided by this tool are not considered to be exact predictions of infrastructure costs over a given period of time but reasonable approximations which provide the public, decision makers and Envision Utah leaders with a relative understanding of how land use effects public investment in infrastructure.

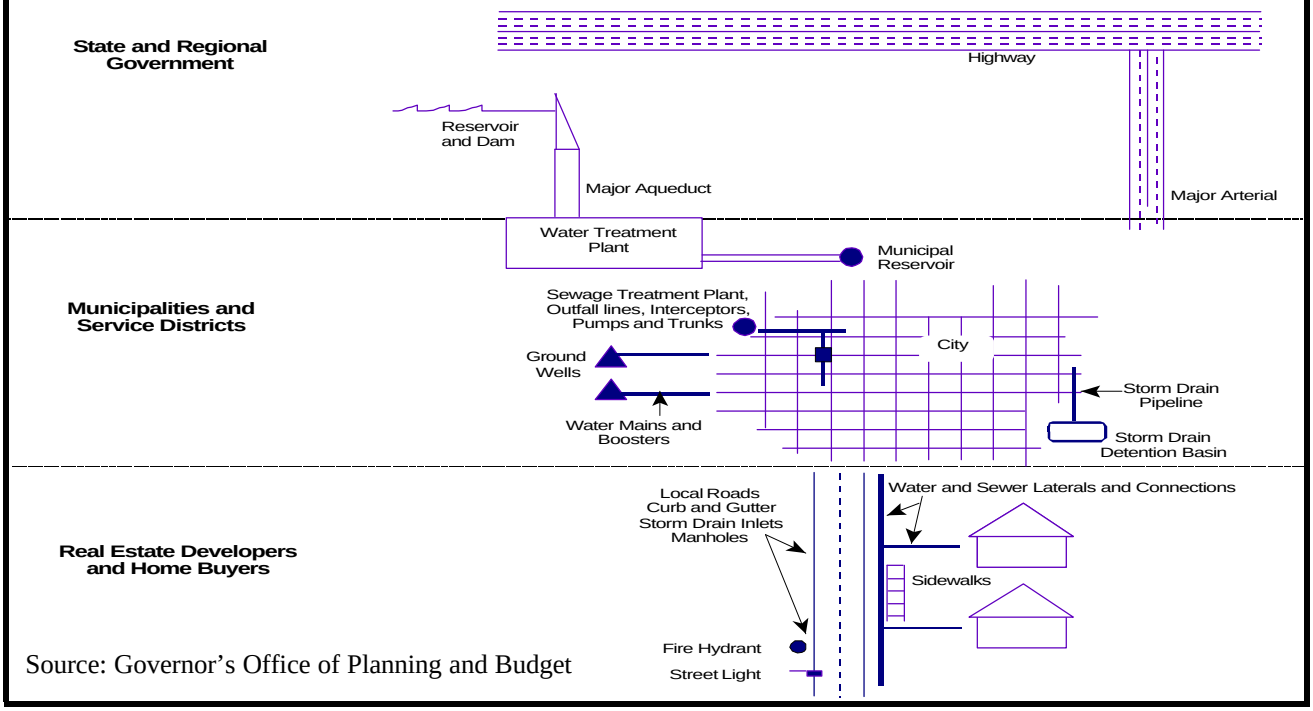
Model Overview
The Infrastructure Cost Assessment Model considers three levels of infrastructure, regional, off-site (municipal) and on-site (developer). These categories follow natural breaks in how infrastructure is provided to the homeowner, community and region.

Regional infrastructure includes projects that are trans-jurisdictional in nature, meaning that they span or provide services to multiple communities. These projects are planned by regional or state governments and financed by state and or federal funds. As seen in Figure 8 the Infrastructure Cost Assessment Model considers two types of regional infrastructure: roads, and water. Projects that are considered to be regional in nature include I-15 construction, development of public transit and water projects such as the development of the Bear River.

The off-site category of infrastructure corresponds with jurisdictional infrastructure provided by municipalities, counties or special districts. The mid-section of figure 8 explains this category to include water and wastewater treatment facilities along with distribution lines, storm drain lines and basins, and minor arterial roads. This level of infrastructure can be thought of as infrastructure improvements provided at the periphery of new development. These projects are financed by local governments through grants, the sale of bonds, levying of impact fees, or tax revenues.

The on-site infrastructure is shown in the bottom portion of Figure 8. On-site infrastructure is classified into the categories of roads, water transmission lines, sewer transmission lines, dry

Figure 8: Typical Distribution of Infrastructure Costs



Source: Governor's Office of Planning and Budget

utilities and storm drains, for simplification purposes. All other supporting infrastructure such as fire hydrants and sidewalks are included in one of the above categories. Private developers generally finance the bulk of on-site infrastructure and reclaim their money through the sale of improved lots. Other developer costs are therefore also included in this category such as site improvement (bull dozing the lot) and professional costs related to the design and building of the infrastructure. A close relationship exists between on-sight and off-site costs in that in the real world these costs are often blurred as to who pays for parts of these levels of improvement. Depending on local policy of a given jurisdiction, some costs classified here as on-site costs may be provided by a municipality or vise versa. The blurring of these categories has been accounted for in the model procedures to insure that no double counting is included in the final estimate.

Specific modeling of each category demonstrates that it does matter how an area is built. Depending on the density of a given area and the method of building used, substantial savings at each of the above levels can be realized. For instance, the regional level demonstrated that clustering allows for more effective transit resulting in more efficient use of public funds.

Off-site costs vary depending on the type and location of new development. When new development takes place within existing development, much of the peripheral infrastructure required to support new development already exists. This provides savings to the community, provides more efficient use of infrastructure and reduces maintenance costs.

On-site costs are shown in this study to be relatively flat for development below two units per acre and above eight units per acre. Development ranging from two to eight units per

acre shows that development costs are reduced drastically through this range. Therefore the most cost effective and efficient use of infrastructure occurs in development of six to eight units per acre.

Regional Costs

The Wasatch Front Regional Council, Mountainland Association of Governments and the Utah Department of Transportation provided regional transportation and transit costs for both the Baseline and the Quality Growth Strategy. The Utah Division of Water resources provided regional water costs. Regional costs are based on the direct results of detailed transportation and water demand modeling performed by these entities as part of the QGET process.

Baseline costs for transportation, transit and water are based on what was in the existing plans as of 1995 with some modifications. These costs are shown on Table 7. The total cost for regional roads in the Baseline comes to $12.6 billion. This figure is composed of nearly 400 projects ranging in size from $0.2 million to $863 million. Larger projects on this list include potions of Legacy Highway, I-80 reconstruction, and I-15. Transportation modeling results for the Quality Growth Strategy indicate that much of the same road network will be required as is designed for the Baseline though some road expansions projects are not needed such as portions of Legacy Highway and some collectors. The estimated total cost for roads in the Quality Growth Strategy comes to about $10 billion.

Under baseline trends housing is developed in a dispersed fashion. Because of the dispersed nature of housing in the baseline, few natural hubs for transit are created making transit less accessible and stimulating little demand for transit. Expenditures for baseline transit is anticipated to total $276 million for additional bus services. Under the Quality Growth Strategy more residential development and jobs sites locate in close proximity to transit so taht transit is more accessible to a greater number of people creating greater demand. The total transit cost for the Quality Growth Strategy comes to approximately $1.7 billion. This number is composed of several transit projects in the Salt Lake, Provo/Orem area and the Ogden Valley. The anticipated land use under the Quality Growth Strategy resulted in the transit rider ship that was projected in Envision Utah scenario D with more than a billion dollars less in infrastructure costs.

Regional water costs were approached much the same way as regional transportation. Based on the baseline demand for water an additional $606 million will be needed in regional water infrastructure. Anticipated projects include the CUP and the Bear River Project. The Quality Growth Strategy results in water savings of approximately 93,200 acre feet of water demanded per year. This savings in demand is substantial enough to delay some parts of the baseline water projects reducing regional water cost for the Quality Growth Strategy to $545 million.

Off-site Costs

The modeling of off-site costs occurred through a two-step process. The first step was to produce estimates on a per unit basis. Per unit estimates were prepared by Psomas Engineering through a collaborative effort with the Division of Water Resources and the Governor's Office of Planning and Budget. Experts working in local, regional and state government also provided valuable input into the development of these estimates. The bulk of the information used in estimating municipal costs came from municipal impact fee studies of selected municipalities and

Table 7: Infrastructure Cost Assessment Results

Baseline			Quality Growth Strategy		
Regional Roads					
I80	$	119	Baseline	$	12,587
2100 S Freeway	$	96	US89 - 12th Converted to Arterial	$	(618)
I15 (600 N - US 89)	$	762	5600 West	$	(300)
Highland Drive (I15 - 9400S)	$	97	Unneeded Collectors	$	(400)
5600 West	$	759	West Lake Adjustment(Utah County)	$	(1,125)
I215 - US89 Farmington	$	380	MAG Refinements	$	(165)
I15 (31st -12th)	$	104			
US89 - 12th	$	863			
West Lake (Utah County)	$	1,500			
UDOT/WFRC/MAG Consensus	$	7,907			
Sub Total Roads	$	12,587	Sub Total Roads	$	9,980
Transit					
Bus	$	276	West / East LR	$	385
			West Jordan Spur	$	190
			West Valley Spur	$	193
			Draper Extension	$	63
			Ogden Rail	$	226
			Provo - Orem Rail	$	672
Sub Total Transit	$	276	Sub Total Transit	$	1,728
Sub Total Regional Transportation	$	12,863	Sub Total Regional Transportation	$	11,708
Water					
CUP	$	526	Baseline	$	606
Bear River Dam	$	80	Unneeded Projects	$	(61)
Sub Total Water	$	606	Sub Total Water	$	545
Total Regional	$	13,469	Total Regional	$	12,253
Local Infrastructure					
On-Site			*On-Site*		
Roads	$	2,706	Roads	$	1,916
Water	$	1,429	Water	$	1,030
Other	$	7,121	Other	$	5,272
Sub Total On-site	$	11,256	Sub Total On-site	$	8,218
Off-Site			*Off-Site*		
Roads	$	329	Roads	$	260
Water	$	594	Water	$	512
Other	$	813	Other	$	689
Sub Total Off-site	$	1,736	Sub Total Off-site	$	1,461
Total Local	$	12,992	Total Local	$	9,679
Totals					
Total Roads	$	15,623	Total Roads	$	12,155
Total Water	$	2,628	Total Water	$	2,087
Total Other	$	8,210	Total Other	$	7,690
Total	$	26,461	Total	$	21,932

special districts and an analysis sponsored by the Utah League of Cities and Towns on the compliance of municipalities with the Utah Impact Fee Act.

Based on the information gathered from municipalities and the professional judgment of Psomas Engineering the median impact fee for roads, water, sewer and storm drains was estimated. It was assumed that the impact fees studied were estimated predominantly for single homes on quarter acre lots. Based on the municipalities sampled, raw-land development was also assumed to be characteristic of the calculated median values for these categories. Impact fee studies for both West Jordan and Syracuse provided breakdowns of impact fees by density. The regional median was then factored by the average percent change obtained from these reports to provide mean per unit costs for various densities.

Infill and reuse developments benefit in that much of the needed off-site infrastructure in the form of roads and storm drains already exist. Psomas Engineering found that municipal roads and storm drains make up 20% to 23% of the total impact fees levied. Based on these findings it was recommended that the median impact fees be reduced by 20% for infill and 15% for reuse. The end result of this process was the schedule of off-site cost by density and land use shown in Table 8. The second step previously referred to is the actual applying of these per unit estimates on a regional basis. This step is explained in detail later.

Table 8: Off-site Cost Schedule

	RAW LAND	INFILL	REUSE
DU*/Acre			
2	$5,512		
4	$4,189	$3,351	$3,561
6	$3,707	$2,966	$3,151
8	$3,485	$2,788	$2,962
16	$3,058	$2,447	$2,600

*Note: DU = Dwelling Unit

On-site Costs

On-site cost proved to be the most difficult and complex level of costs to estimate on a per unit basis. The complexity and difficulty is due to the multiple ways subdivisions can be designed based on size, available land and the negotiating that takes place between developers and municipals. To simplify these and other variables, a simulation model was designed by Psomas Engineering to predict a mean per unit estimate. The model has the ability to create estimates by density. Three variations of the original model were created to produce estimates by land type as well.

The simulation model was prepared based on actual estimates and sketch designs. These estimates and sketches are composed of detailed information of the infrastructure that is necessary to prepare a parcel of land for residential development based on conformity to Salt Lake City building code. The simulation model uses input data for parcel size and density then calculates a standardized lot size (net lot size, depth, width) the relationship of the lots within the parcel (rows, tiers, block length, street width), and the quantity of materials required (square ft. of roads and linear ft. of water, sanitary, storm drain, and dry utilities). The model uses actual and sketch information as a starting point in that analysts provide the model with categories and static information. The heart of the model is in the relationship between design components and standardizations that are made to the data based on civil engineering techniques and mathematical formulas. The importance of this model is that it provides mean values that do not suffer from statistical errors that could exist from using sample information from multiple sites.

Because this model is built out of mathematical relationships it is possible to insert a variety of densities into the model and receive varied per unit costs by density. Per unit costs were developed for densities of 2 (raw only), 4, 6, 8 and 16 units per acre. Four models in total were developed for different land uses. An index model was designed as the base model. The other models vary from the index model in that the raw land model accounts for peripheral roads that are general to raw land development, the reuse model accounts for demolition costs and a parcel size of 10 acres, and the infill model is based on a parcel size of 5 acres.

Cost estimates produced by the simulation model include, roads, sidewalks and gutters, water and sewer transmission lines, storm drain lines and basins, dry utilities (gas, electrical, phone, cable, etc.), area costs (site preparation, bulldozing), and fees assessed to the developer (permits, contingency, engineering). These categories are estimated based on the predicted quantity of materials required on a per unit basis. The estimation is based on land use and lot size. Once the model predicts the quantity of actual materials that are necessary, an average cost coefficient per unit of material is applied to arrive at the estimated cost per category. These categories are then aggregated to arrive at a total per unit cost. Table 9 shows the schedule of on-site costs by density and land use. The application of these per unit estimates on a regional basis is explained next.

Table 9: On-site Cost Schedule

	RAW LAND	INFILL	REUSE
DU*/Acre			
2	$40,781		
4	$24,551	$20,777	$23,935
6	$16,805	$14,289	$16,394
8	$13,762	$10,962	$12,609
16	$8,889	$7,487	$8,892

*Note: DU = Dwelling Unit

Application Of On and Off-Site Costs

The Baseline and Quality Growth Strategy are prepared in a Geographical Information System (GIS). GIS is essentially the ability to associate data with a geographical reference point. For both scenarios, GIS places the entire region into a matrix. This matrix is composed of 50-meter cells for the baseline and 30-meter cells for the Quality Growth Strategy. Each cell then contains a value that indicates the number of units located within that cell. The baseline was prepared by taking current land use and populating cells to represent the baseline population controls. Housing density was based on the density of the neighboring cells. Average household size was used to match population with the number of new units.

The Quality Growth Strategy is a representation of what future development may look like under the Envision Utah strategies. The Quality Growth Strategy represents development as occurring through eight broad categories called development types. Each type being defined by specific land use characteristics such as residential area, density, jobs and population. GIS cells received a code representing one of these eight development types.

The cost model used GIS to count up cells based on development and type to derive number of new housing units by density and type of land use (raw, infill, and reuse). Reuse is defined as cells with new population in 2020 over the top of cells existing population as of 1997. Infill development is considered to be development that occurs within areas that were heavily developed as of 1997. Raw land is all development occurring on the periphery of the existing 1997 population.

The GIS exercise results in around 30,000 cell aggregations of like cells next to one another for the Baseline and about 50,000 for the Quality Growth Strategy. Both scenarios result in a total of 380,963 new homes. Piecewise log linear mathematical functions were fit to the on and off-site cost schedules.[7] Ten functions were fitted with a limited domain. Clusters were sorted by land use and by density. Four of the ten functions applied were applied to raw land. The clusters were assigned to one of the four functions based on the density value from 2-4, 4-6, 6-8 or 8-16. Clusters with densities outside of this range received a dummy value of the extreme point in the range. This procedure was justified because density estimates lower than two units per acre proved on average to be flat. Infill and reuse had domains of 4-6, 6-8 and 8-16. Infill or reuse clusters with values lower than four were treated as raw land.

Assessment Limitations

Costs estimates produced from this process should not be considered to be exact predictions of future costs but rather as reasonable estimates of how infrastructure costs differ as land use is changed. This assessment is based on mean values. Average costs were used in this assessment and therefore limit the ability of this process to predict costs at a smaller geography. For this assessment changes in soil, slope, public policy and existing infrastructure capacity have been generalized whereas at a local level these conditions will be site-specific and could yield different results.

This model continues to be a work in progress. The procedures and estimates used here have changed as this work has become more refined and will continue to be refined. Three changes have been made to the assessment procedure since the analysis of the four Envision Utah Scenarios. First, the method of estimating on-site costs has been changed because of that additional research on municipal impact fees. These fees where previously estimated as being driven by only linear costs. Additional research has shown that these costs increase and decrease at a lower rate than was previously anticipated.

Second, additional work was also performed on the on-site simulation model. Utility costs were simplified by the application of a single procedure for dry utilities rather than a bundle of costs. Dry Utilities is a method being implemented in California to simplify the work and the cost of installing utility services within a subdivision. Dry Utilities requires that one trench be made and that utility suppliers coordinate their activities to provide all services in one trench. Other minor adjustments were also made to the mathematical calculations within the model to simplify some of the procedures and to allow for control numbers to be produced by the model to insure the quality of the estimates.

Finally, adjustments have been made to the mathematical functions used. Previously, a single power function was fitted for each land use whereas now a piecewise log linear method is utilized. This new method produces no significant change to the assessment. The piecewise log linear method was decided on because of the exact fit it produces with the estimates. The most significant change to the model is the production of a raw land estimate for two dwelling units per acre. Previously the power function had been capped at two units per acre based on professional judgment and the extrapolation to this point was produced by the power function. For this assessment the simulation model prepared an estimate for two units per acre.

[7]The mathematical relationship is: e ^ price = Slope* ln (density) + Y intercept.

Model Findings

The estimates prepared for on and off-site costs for this assessment show that dramatic change in per unit costs occur between seven and two units per acre. Lowering densities in this range can result in much lower costs at these levels that are eventually born by homeowners and municipals. Additional research showed that maintenance costs are approximately 40% of the total cost. Reduction in density can significantly reduce maintenance costs as well as upfront capital costs.

The Quality Growth Strategy did not show a significant decrease in the average residential density for the region. The Strategy did make better use of land with in existing developed areas in the way of infill and reuse development. Because of infill, reuse and a larger mix of residential housing transit accessibility improved dramatically. The use of existing urban land for residential use also showed up in some on and off-site cost savings for the region.

Analysis Results

The Baseline land use results in a total on-site cost of $11.2 billion and off-site costs $1.7 billion. The difference in the Baseline costs reported in this analysis and those reported in previous analysis stems from refinements made to the Infrastructure Cost Assessment Model. The same assessment procedures were used in this analysis for both the Baseline and the Quality Growth Strategy. The results for the Quality Growth Strategy showed substantial savings in on-site costs and some sizable savings in off-site costs. Total on-site cost for the Quality Growth Strategy totaled $8.2 billion and $1.5 billion in off-site costs. Due to the difficulty in determining density to cost relationships for off-site costs it is felt that this analysis could be over-stating off-site cost in the Quality Growth Strategy. Additional model development is planned to help better understand the nature of off-site costs.

Strategy Analysis: Appendices

Appendix A: QGET Technical Committee

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Appendix B:
QGET Technical Accomplishments

The QGET Technical Committee has been working since the summer of 1996 to improve the collective technical capabilities of the state to plan for growth. The purpose of this effort is to enhance technical modeling tools, data, and processes so that decision-makers have comprehensive, reliable, accessible and consistent growth related information. As a direct result of the QGET effort, there have been significant investments made in models, applications, data development, and data delivery systems. The results of these efforts through March 1999 are listed in the report, *Scenario Analysis*, available from the Governor's Office of Planning and Budget. A list of accomplishments since March 1999 follows.

Economic and Demographic Projections
Governor's Office of Planning and Budget

Baseline Projections
A new baseline projection has been produced. Over a period of six months, critical review and primary research were incorporated as the baseline was revised three times. This included a first draft then revision to support the Occupational Projections Program of Workforce Services (Rev. 08/1999) and new official baseline planning projection (revised three times and released 01/06/2000). These projections through 2030 may be accessed here: http://www.qget.state.ut.us/projections/

2050 State Level Scenario Analysis
A ceterus paribus sensitivity analysis (scenario study) was produced and presented for the Wasatch Front Economic Forum (05/1999). Using the state's long term simulation model (Utah Process Economic and Demographic model) eleven scenarios were produced to identify the range of possible future paths to the year 2050 for population and employment. High, medium, and low time paths for model exogenous variables and parameters (economic growth, fertility, life expectancy, and labor force participation) were explored. A literature review of current modeling practices and methods informed the exercise. A brief summary of this project may be accessed here: http://www.qget.state.ut.us/projections/Utah2050/index.htm

Baseline Projections Research and Review Process
In the six months leading up to the release of the new baseline, there was an extensive outreach (meetings, presentations, etc.) to state agencies, state and local planners, elected officials, technical analysts / experts to develop the assumptions for the projections. This included training sessions on the UPED model logic, methods and output evaluation. Impact results, short-term economic forecasts, and industry forecasts were explicitly included. Assumptions, results, and post-processed analyses were posted interactively to a password protected "Draft 2000" web site. Each new version (there were four) was posted for additional review. Some of the review materials are available here: http://www.qget.state.ut.us/projections/draft2000baseline/

Parameter and Exogenous Variable Estimation and Projection
New methods were implemented to project fertility, survival, and labor force participation rates and export sector employment (including trend, short run, industry, firms, and special studies). This effort included literature review, data development, new estimates, and projections. An example of the results of this work may be accessed here:

http://www.governor.state.ut.us/dea/demographics/liftab/lifetable.html

Impact Work
A variety of impact studies were completed and the results included in the 2000 Baseline Projections. These were collaboratively produced with the other GOPB analysts whose areas of expertise include short-term econometric forecasts, input-output modeling, and financial impact research. The research projects included the Olympics, Intel, Circle Four, Grand Staircase and others. Additional impact evaluation software was developed and implemented. An example of the impact work as it relates to the projections is available here: http://www.qget.state.ut.us/projections/draft2000baseline/sld021.htm

Additional Development Efforts
Among the development efforts of the Projections Program in 1999 were a) further integration of UPED with the fiscal impact model work, b) refinements to the general-purpose gravity model, c) completion of a major database to web programming effort and associated documentation, and d) completion of the data component of the interactive, online, database driven county profiles. Many county data sets were developed and web enabled for the first time. The interactive profiles may be accessed here: http://www.governor.state.ut.us/dea/Profiles/profiles.html

UrbanSim Land Use Model Development
Urban Analytics, Utah Automated Geographic Reference Center, Wasatch Front Regional Council, Mountainland Association of Governments, and Governor's Office of Planning and Budget.

Purpose
Best practice in transportation modeling includes considering the relationship between transportation infrastructure and land use development. UrbanSim will allow Utah transportation planners to systematically consider this relationship.

Overview
UrbanSim models land development by simulating the real estate market. The model is based on a view of urban development as it evolves over time and space as the composite outcome of the interactions of individual choices and actions taken by households, businesses, developers, and governments. The model's structure includes components reflecting the behavior of households, businesses, developers, and governments, all interfaced through the real estate market. This behavioral approach provides a transparent theoretical structure that is much less like ‘black-box' or abstract urban models that do not clearly identify agents and actions being modeled. As such, it becomes much more straightforward to explicitly incorporate policies and evaluate their effects.

Implementation
The model is being implemented in a public and an official version. The public version is available to interested members of the public. The official version is available to a limited group of transportation planners. In practice, the differences between the public and official version involve the input data being analyzed. The public version uses input data reflecting the most current long range transportation plan. The official version uses data reflecting work in progress on a variety of transportation projects.

Transportation Modeling
Wasatch Front Regional Council, Mountainland Association of Governments, Utah Department of Transportation, and Michael Baker, Inc.

Strategy Analysis

Revised Transit Networks
Transit networks were revised to ensure that direct service was provided to the areas that the QGS designated for higher density and walkable developments. Where those developments were along rail lines, station locations coincided with the center of the village and in some cases rail lines were modified to serve the towns and villages. In the cases where direct rail service did not exist the bus service was tailored to provide good connections to the rail system.

Revised Procedures to Model Walk/Bike Trips
A certain percentage of trips by traffic zone are walk/bike. In order to better reflect the walk/bike share of trips, intersection densities were modified to exclude the areas which were undeveloped.

Infrastructure Assessment Model
Governor's Office of Planning and Budget, Utah Division of Water Resources, and Psomas Engineering

Municipal Cost Refinements
Used League of Cities and Towns data on impact fees to develop municipal cost estimates as a function of density. Previously, calculations were based on a theoretical approach only.

Cost Function Refinements
Cost estimates were developed for densities of 2, 4, 6, 8 and 16 dwelling units per acre. A piecewise log-linear cost function was developed. This approach ensures that the estimate for a given density is included in the cost function.

Cost Analysis
Used the assessment model to analyze the Quality Growth Strategy.

Appendix C: Envision Utah Goals and Strategies

I. Enhance Air Quality

- Foster and promote walkable development where feasible
- Promote the building of a region-wide transit system to make transit more convenient and reliable
- Foster transit-oriented development
- Encourage polluters to use best available technology to meet, and where possible, exceed industrial emissions standards
- Encourage energy efficiency ordinances
- Promote creation of a network of bikeways and trails, especially commuter trails linking daytime destinations
- Support strategies to reduce ozone and save energy
- Promote telework

II. Promote Mobility & Transportation Choices

- Promote the building of a region-wide transit system to make transit more convenient and reliable
- Foster transit-oriented development
- Foster and promote walkable development
- Advocate an increase in the capacity of east-west transportation links (recognizing that some communities may have a greater need for additional north-south arterial capacity)
- Promote creation of a network of bikeways and trails, especially commuter trails linking daytime destinations
- Encourage job locations to include retail and services in a walkable configuration to reduce driving between daytime destinations
- Encourage the addition of carpool lanes and promote incentives for their use
- Promote purchase of rights-of-way for future transit system
- Promote telework
- Encourage reversible lanes where feasible to reduce peak hour congestion and take advantage of unused road capacity

III. Preserve Critical Lands, Including Agricultural, Sensitive, And Strategic Open Lands (Such as Wetlands, Parks And Recreational Lands, Watersheds, And Steep Slopes) And Address The Interaction Between These Lands And Developed Areas

- Promote walkable development that encourages permanently reserved open lands through incentives
- Promote tax incentives for reuse of currently developed areas
- Support the establishment of transfer of development rights programs to promote protection of open space and maintain quality of life
- Support the protection of sensitive lands
- Promote use of conservation easements to preserve key/critical land for parks and recreation, open space, wildlife habitat, and agriculture, providing public access where appropriate, and organizing these areas into a regional network to the extent possible
- Encourage the dialogue and ongoing public discussion of how to identify significant public and/or private funds, and the appropriate balances of these, for critical lands preservation.
- Pursue public land trades to create more private developable land, preserve critical lands and watersheds, and protect sensitive lands from development

IV. Conserve & Maintain Availability of Water Resources

- Foster and promote walkable development
- Advocate restructuring of water bills and other techniques to encourage conservation, and to help water providers encourage conservation.
- Provide information regarding and encourage the use of low-irrigation landscaping, drought resistant plants (xeriscaping), and low water-use appliances, as well as encouraging government entities to demonstrate this on their properties
- Promote the use of greywater and secondary water systems
- Encourage the use of leading edge technologies for water conservation
- Encourage interjurisdictional cooperation

V. Provide Housing Opportunities For a Range of Family And Income Types

- Foster mixed-use and walkable neighborhood zoning to encourage a mix of housing types—including multi-family—for a mix of incomes
- Promote density bonuses to developers to promote development of affordable housing
- Support implementation of energy efficiency ordinances
- Provide information regarding developer incentives and tax breaks for development of affordable and mixed-income housing
- Create local housing trust funds to develop and maintain affordable housing
- Encourage cooperative region-wide fair share housing policies
- Support "cool communities" and other strategies to reduce ozone and save energy
- Develop a program of incentives to local governments to develop and implement plans for affordable and mixed-use, mixed-income housing

VI. Maximize Efficiency in Public & Infrastructure Investments

- Encourage local zoning ordinances that promote walkable development and preservation of open space
- Encourage energy efficiency ordinances
- Promote the reuse/redevelopment of currently developed areas
- Encourage reversible lanes where feasible to reduce peak hour congestion and take advantage of unused road capacity
- Establish a Transfer of Development Rights program to encourage land owners to build in currently developed areas rather than on sensitive lands
- Promote the building of a region-wide transit system to make transit more convenient and reliable
- Advocate clean-up and re-use of brownfields

VII. Revise Tax Structure to Promote Better Development Decisions

- Promote open discussion about tax policy as it relates to development

Appendix D: Envision Utah and the Quality Growth Commission

Quality growth planning in Utah includes the work of many entities, including contributions from all levels of government (federal, state, and local) and the private sector. The Quality Growth Commission and Envision Utah are two of the most visible quality planning entities, each involved in related, as well as, separate planning activities. Understanding the similarities and differences of both entities and their activities illuminates the extent of coordination present, as well as the independent activities of each. Keeping the work of both entities as complementary and productive is an ongoing challenge.

Quality Growth Commission

The Quality Growth Commission is established to advise and recommend to the legislature Utah's guiding principles for quality growth and their respective implementation policies. The Commission was established by "The Quality Growth Act of 1999" and has existed since May 1999. The membership of the commission was appointed by the Governor and approved by the Senate and includes representatives from state government, local elected officials, the Utah Home Builders Association, the Utah Association of Realtors, the agricultural community and the private/non-profit sector. The Commission has participated in the funding of several planning activities, held public meetings around the state, and begun the process of making legislative recommendations regarding quality growth. The Commission is staffed by the Governor's Office of Planning and Budget, League of Cities and Towns, and Utah Association of Counties.

Envision Utah

Envision Utah is a public/private community partnership dedicated to studying the effects of long-term growth in the 10-county Greater Wasatch Area of northern Utah. The partnership was formed in 1997 and the membership includes over 100 partners from the business, academic, conservation, local and state government, and religious communities. Its purpose is to create and be an advocate for a publicly supported growth strategy that will preserve Utah's high quality of life, natural environment, and economic vitality. During the past three years, Envision Utah has directed many activities, including an in depth values study, baseline analysis, over 100 public workshops, scenario development and analysis, a million dollar public awareness campaign, and the development and analysis of a quality growth strategy. Envision Utah has its own staff and operates mostly with private funds and no direct state financing, but much of its technical work has been prepared by a state/local technical committee coordinated by the Governor's Office of Planning and Budget.

Similarities and Differences

The Quality Growth Commission and Envision Utah possess many similarities. Both entities are dedicated to preserving and enhancing the quality of life present in Utah. Both entities are devoted to involving the public in decisions about future planning and view Utah residents as their ultimate constituency. The membership of both entities includes some overlap; six of the Commission's 13 members are partners of Envision Utah. The technical staffing of each is coordinated by the Governor's Office of Planning and Budget. And, both entities have joined to fund local quality growth demonstration projects, thereby leveraging their resources to increase the funding devoted to community planning activities.

Jointly funded projects include the following:

- **Centerville** – Proposing a mixed use development, integrating affordable housing, open space and compact, high density development on greenfield acreage

- **Provo** – Proposing a pedestrian-oriented neighborhood node, including medium to high density housing and retail, around a key inter-modal transportation center

- **Salt Lake City** – Proposing a transit-oriented block adjacent to the new library

- **West Valley City** – Proposing a compact, mixed-use infill and redevelopment project along the Jordan River Corridor

- **Brigham City/Perry** – Proposing a compact, mixed-use, mixed-income development on greenfield acreage on the border between two communities

- **Sandy/Midvale** – Proposing a joint planning effort to create a transit-oriented development that includes senior housing along a light rail corridor

In each of these projects, the financial resources of the Quality Growth Commission and Envision Utah have been pooled with local monies. Partnerships such as these demonstrate the degree to which the entities have common interests and work productively to serve the public good.

But there are many important differences. The entities are administratively separate and entirely independent of one another. While the common membership and staffing help to coordinate the basic research and direction of both entities, the specific focus of each entity is different.

Envision Utah's focus is the creation of a broad, regional vision and the analysis, public education, and advocacy required to achieve this vision. Many have referred metaphorically to Envision Utah as the "road" – thereby highlighting that Envision Utah's emphasis is on the vision, the ultimate destination. Envision Utah has absolutely no regulatory power.

In contrast, the Quality Growth Commission has been termed by some as the "vehicle". The Commission is devoted to making legislative recommendations that will help local communities and the state achieve quality growth. Consequently, the Commission has a specific legislative mandate to advise legislation on growth management issues, including critical land conservation, home ownership, housing availability, and efficient infrastructure development. The Commission, therefore, is in an influential position to make quality growth happen.

The Commission has complete independence to form its own vision separate from Envision Utah's. However, in doing so it is certain to benefit from the significant amount of resources, public input, analysis and other achievements devoted to creating Envision Utah's vision and implementation strategies. Likewise, Envision Utah will benefit from the pragmatic approach of the Quality Growth Commission, an approach that must be well-grounded in what is legislatively desireable and feasible.

There are other specific differences as well. Envision Utah, as presently conceived, is focused on the region which includes the northern metropolitan area and adjacent counties. The Quality Growth Commission's

mission is statewide. Envision Utah has been working on quality growth planning for 2 ½ years longer than the Commission and therefore has a variety of completed products and planning processes, while the Commission is still in its infancy. The Commission will progress faster because of the technical foundation Envision Utah and state and local governments have created.

Future Coordination

The work of both entities will continue to augment and complement one another. Envision Utah is currently taking the Quality Growth Strategy to the doorsteps of the entire Greater Wasatch Area. Currently, the Quality Growth Commission has not taken a formal position in regards to Envision Utah's Quality Growth Strategy. However, the research supporting the Quality Growth Strategy informs the work of the Commission and will continue to provide a technical basis for the overlap of both groups.

In the coming months, the Quality Growth Commission will spend a significant amount of time formulating quality growth principles. This work, in turn, instructs Envision Utah's efforts as their Quality Growth Strategy is unveiled and implementation steps are planned.

The public is well-served when both entities pool financial resources, share technical work, and remain vigilant in promoting an attractive quality of life for Utah residents. An ongoing challenge will be to capitalize on the joint initiatives of both groups, while eliminating redundant tasks. It only stands to reason that the public will be better served if both entities move in a harmonious direction.

Appendix E:
State Role in Quality Growth Planning

Note: This write-up is taken from a staff presentation prepared for the Quality Growth Commission. It is included here because of its relevance to quality growth planning activities in state government.

The Quality Growth Commission has only begun the process of understanding and helping to shape the role of the state in quality growth planning. The Commission has been presented a significant amount of background information regarding the state's role.

As a starting point, the Commission sought to define quality growth and improve their understanding of the rationale for and history of state involvement. Understanding public sentiment about the growth issue was also deemed important and the Commission was presented key indicators. The Commission has also listened to staff presentations regarding Governor Leavitt's ideas about the principles of enhancing the quality of life present in Utah. And, the importance of the market economy has always been a factor in considering state involvement.

These issues – defining quality growth, rationale for and history of state involvement, public sentiment, guidance from the Governor, and importance of the market – provide a context for defining the state's role. The following provides a summary of these contextual issues and concludes with the basic categories of state involvement as presently conceived by the Governor's Office of Planning and Budget.

Defining Quality Growth

Commission members recognize the difficulty of defining quality growth. Chairman Lewis Billings has even encouraged Commission members and staff to "take a picture of quality growth when you see it so we can begin to understand it better."

The process of defining quality growth will be an ongoing process. However, the Commission has agreed on a general view of quality growth. The Commission views quality growth as the creation of a responsible balance between the protection of natural systems – such as land, air, and water – and the requisite development of residential, commercial, and industrial land to accommodate an expanding economy and population.[8] Implicit in this definition is the recognition of tradeoffs and the need for balance, as well as the challenges and opportunities that growth affords.

Rational for and Recent History of State Involvement

The Quality Growth Act of 1999 was passed because the legislature recognized the challenges created by a growing economy and population and the ability of the state to positively impact current and future development. The increased costs of providing infrastructure, the disappearance of farm land and open space, the rising costs of housing, and the importance of an attractive living environment (including amenities such as clean air, uncongested traffic, and access to recreational opportunities) have all resulted in a more significant state effort.

This effort began with the Growth Summit in 1995, a conference sponsored by legislative leadership and the governor intended to result in legislative solutions to the growth challenges facing the state. Over 60 proposals suggesting

[8] *See Planning and Growth Management,* John M. DeGrove, Lincoln Institute of Land Policy

ways to manage the state's growth were submitted. The Summit resulted in a 10-year transportation improvement plan for the state.

The following year the Governor created the Utah Critical Lands Committee. This Committee supported numerous open space projects and developed educational materials describing the tools and techniques for open space conservation.

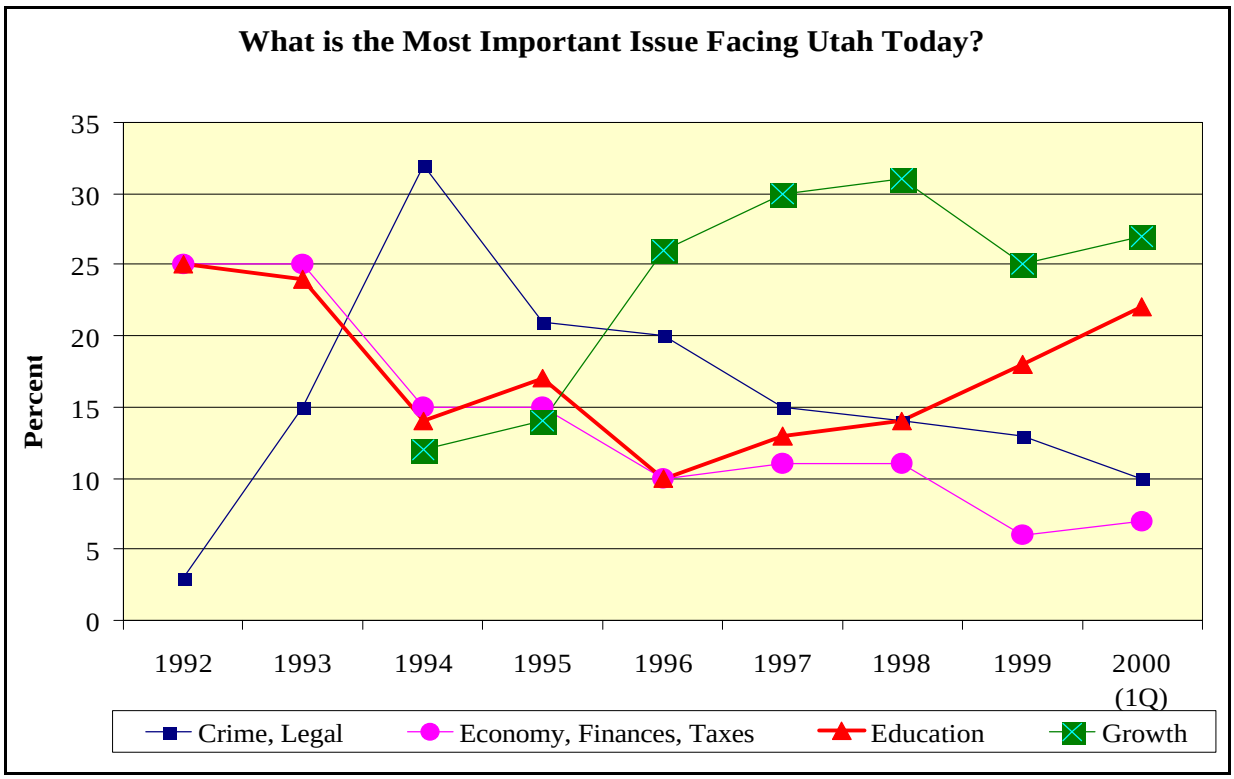
In 1996, the state partnered with Envision Utah, a public/private community partnership dedicated to studying the effects of long term growth, creating a publicly supported vision for the future, and advocating the necessary strategies necessary to achieve this vision. Governor Leavitt is the Honorary Co-Chair of Envision Utah and six of the 13 members of the Quality Growth Commission serve as partners.

The Growth Summit, Critical Lands Commission, and Envision Utah laid the foundation for the passage of the Quality Growth Act. The Quality Growth Commission has benefitted tremendously from these efforts and has tried to build from their accomplishments.

Public Sentiment

The Commission views the public as the ultimate constituency and has tried to understand public perceptions about growth. The public clearly views growth as a vital issue. In fact, with the exception of one quarter, surveys show Utahns have consistently viewed growth as the most important issue facing the state since January of 1996. Other important issues such as crime, education, and the economy/taxes have also been identified, but the frequency is significantly less than that of the growth issue.

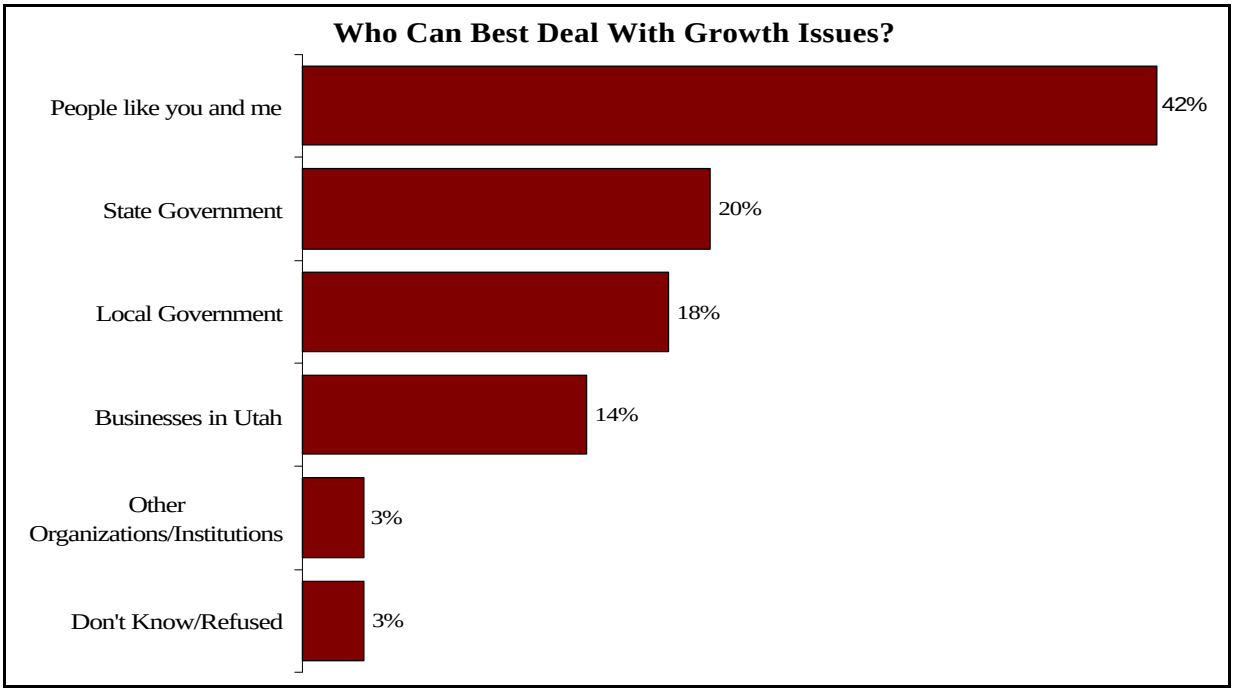
Figure 9



Source: Utah Consumer Survey, Valley Research, Inc.

Strategy Analysis

Figure 10:



Source: Worthlin Worldwide

Opinion research also shows that the public recognizes the role of the state, although individual efforts are viewed as primary. Worthlin Worldwide, an internationally reputable polling firm, has probed focus groups regarding the issue of who can best deal with growth issues. The public identifies, by a wide margin, the individual acts of residents as the entity best able to deal with growth. State government ranks second with 20%, followed by local government (18%) and business (14%). Clearly, the state is viewed by the public as one of many meaningful contributors to managing growth issues.

Guidance from the Governor

Governor Leavitt has been a vocal advocate and supporter of quality growth planning in Utah. In addition to helping to initiate the original Growth Summit and issuing the Executive Order creating the Utah Critical Lands Committee, he serves as the Honorary Co-Chair of Envision Utah and was an active supporter of the Quality Growth Act during the 1999 General Legislative Session.

The Governor has articulated essential philosophical positions regarding the state's role and responsibility in the quality growth planning arena. His guidance has been placed within the context of the importance of a prosperous economy and market activity.

The mantra of "local control, central coordination" has been the fundamental, guiding theme of the Governor's philosophical approach to the state's role. The Governor has also been adamant that maintaining affordability must be a primary focus of the state, even while the state invests in critical infrastructure. Promoting a conservation ethic – critical lands, water, energy, and other natural resources – is another function

of the state and essential to quality growth planning. And, the Governor has been adamant that planning for the future is essential and the state must make planning a high priority.

The Governor advances these positions through the work of his staff and state agencies, as well as specific programs or efforts such as the Digital State initiative, Envision Utah, and the 21st Century Communities Program.

Importance of the Market

The role of the state cannot be considered without first reaffirming the importance of the market in achieving quality growth. The Commission has discussed and had information presented regarding the benefits of a market economy and the importance of limiting government intervention in market activities. Economic theory and practice have demonstrated that market economies prosper because of the efficiencies and entrepreneurial activity present.

The Commission pragmatically recognizes that state government policies will shape market activities whether inadvertent or purposeful. One role of the Commission, therefore, is to better understand the impact of state policies on market activities and ensure positive outcomes. The growth dialogue has the potential to serve as a catalyst for a market environment that is less encumbered by government intervention or decisions, while at the same time correcting market activities that do not serve the public interest.

Significance of the State and Broad Categories of Involvement

While the Commission continues to fine-tune its interpretation of the role of the state in quality growth planning, it is clear that the state plays a prominent role and therefore has great potential to influence development activities.

State government, when broadly defined to include the activities of state departments, State Trust Lands Administration, as well as higher and public education, employs approximately 57,000 people, or 5% of all jobs in the state. The state owns an estimated 10% of the state's land base and administers in excess of a $6 billion budget. Clearly, the state has the power to shape selected aspects of growth and does so everyday whether unintended or deliberate.

The Commission has been presented five broad categories that are central to the role of the state in supporting quality growth:

- **Coordination and Leadership**
- **Information Provision and Technical Support**
- **Infrastructure Investment**
- **Public Finance**
- **Regulatory Authority**

Coordination and Leadership

Coordination and leadership is viewed as critical in a complex environment consisting of 20 state agencies, 7 associations of government, 236 municipalities, 29 counties, and approximately 300 special districts. These political entities exist within a functional regional framework of airsheds, watersheds, commutersheds, and natural systems. It is a massive undertaking to help these entities to work well together.

Information Provision and Technical Support

State government possesses a wealth of data and technical expertise. It is inefficient for smaller entities to develop some types of technical sophistication and data. Consequently, state government fills a vital role as a collector and sharer of information, and as a purveyor of professional assistance. In terms of quality growth planning, for instance, the state collects, organizes, and analyses data on land constraints,

water supply, land uses, economic and demographic trends, air quality, transportation performance, fiscal impacts and other issues.

Infrastructure Investment
Every time the state invests in highways, water resources, wastewater treatment projects, correctional facilities, higher education facilities, and other types of infrastructure it is shaping the type and location of growth. As an example, consider how past decisions about the location of Interstate 15, vis-a-vis U.S. 89, impacted the economies and land uses in central and southern Utah. Or, consider how government decisions about water development influence where population and agricultural activities can prosper. In fiscal year 2000 alone, state government spent $955 million in transportation and water infrastructure. The state not only has a significant interest in making prudent investments financially, but in making sure these investments serve the broader interest of quality growth.

Public Finance
The taxing and spending activities of state government significantly impact growth. Choices about how the state funds projects and how the state allocates local revenues impact the type and location of growth. For instance, using the sales tax to build highways is a significant public policy decision. Prior to the creation of the Centennial Highway Fund, gas taxes were the primary source of revenue for road construction. Now, a large portion of the Centennial Highway Fund is paid for through the state's general fund (primarily sales taxes). The use of sales taxes for road construction spreads the burden of constructing these roads broadly among all taxpayers. Gas taxes, on the other hand, direct the tax burden to those who drive the most. Each funding mechanism presents different incentives and illustrates the significance of budgetary decisions.

The distribution of local-option sales taxes is another example of the significance of state actions on quality growth. The point-of-sale portion of the distribution formula – which is 50% – places cities in a competitive situation for certain types of commercial development. For instance, from a strictly revenue-based standpoint, local governments would sometimes prefer a car dealership to any other type of development even if it didn't make sense from a neighborhood and community development standpoint. Again, the funding mechanism introduces different incentives and effects the type and location of development.

Regulation
The state has an obligation to the public to appropriately regulate activities that impact the health and safety of residents. In the arena of quality growth, air and water quality are of particular importance. Here, the state's role is to efficiently monitor air and water quality, and take regulator action when necessary.

Conclusion
The Commission has not formally agreed upon the precise role of the state in quality growth planning. The Commission has, however, considered how to define quality growth. They view it as a balance between the protection of natural systems and the development necessary to support growth. The Commission's inquiry into the role of the state has benefitted from the foundation established by prior quality growth planning activities such as the Growth Summit, Critical Lands Committee, and Envision Utah. Surveys related to public perceptions about growth and the state's role have also been considered, as have the Governor's leadership and the importance of the market. The

Commission is comfortable characterizing the role of the state as a coordinator, leader, policy maker, technical resource, investor, and regulator. The more specific underpinnings of the state's role will emerge as the Commission continues to define the principles of quality growth during the coming year.

Appendix F:
Quality Growth and the Market

Note: This essay was prepared by the Governor's Office of Planning and Budget to illuminate ways in which a market economy and quality growth planning relate to one another. It is included here because of its relevance to the Envision Utah process.

The relationship between quality growth and market principles is a relevant policy issue. The Quality Growth Act of 1999 and the Envision Utah regional visioning process have stimulated significant public dialogue about the relationship between quality growth and the free market; this dialogue has also reaffirmed the importance of both.

Quality growth, while difficult to define, implies a commitment to plan carefully and prudently for growth so as to achieve a responsible balance between the protection of natural systems (land, air, and water) and the development required to support growth and provide economic opportunity for residents. To achieve quality growth an area must seek a responsible fit between development and the infrastructure needed to support the impacts of development (roads, schools, water, sewer, and utilities).[9] Wise stewardship, extensive coordination, and prudent investment are all key components of quality growth.

The free market is much more easily defined; it is a summary term for an array of voluntary exchanges that occur in society. Individuals or entities exchange commodities because both expect to gain from the trade. Both parties can benefit because each values the commodities differently.[10] Economic theory and practice have demonstrated that market economies prosper because of the efficiencies and entrepreneurial activity present.

The discussion about quality growth and the free market centers around Utah residents' interest in preserving the quality of life in Utah (such as clean air, affordable living, and open lands), while simultaneously benefitting from a market economy that increases wealth and income for Utah residents. This important dialogue has the potential to serve as a catalyst for creating a market environment that is less encumbered by government intervention. To understand this potential it is useful to recognize two practical points about land use decisions and then consider the free market principles of private property rights, choice, user-based pricing, provision of information, and competition.

Practical Points Regarding Land Use

To understand land use in the context of a market economy, it is helpful to remember that land uses are regulated through local ordinances and shaped by federal, state, and local government polices. Consequently, land use is not currently governed by a free market, nor is it governed exclusively by local government. Rather, Utah's land uses result from decisions made by all levels of government and the private sector. These practical realities are important because they demonstrate the extent of government intervention present in our current market system and portray the potential for altering government involvement to better serve the public good.

Zoning is the primary and most direct mechanism for regulating land use. Within the Greater Wasatch Area, nearly 100 cities and

[9] *Planning and Growth Management in the States*, Lincoln Institute of land Policy, John M. DeGrove
[10] *Fortune Encyclopedia of Economics*, "Free Market", Murray N. Rothbard

towns and 10 counties formulate local ordinances that influence choices about where, when, what, and how development will occur. This regulation or zoning is deemed appropriate because of the community benefits that occur when land uses are arranged to maximize the health, safety, and welfare of a community. Some people suggest that quality growth planning efforts will necessarily result in more government intervention. However, it is equally likely that increased public dialogue about quality growth will result in less, different, or more creative local land use controls.

In addition to the zoning of land uses, land use decisions result from a combination of federal, state, and local government decisions about infrastructure investment and tax policy. Policies regarding the federal interstate system, water projects, and tax code influence where and what type of development are feasible. As examples of the importance of the federal government in shaping land uses in Utah consider how the location of Interstate 15 impacted the land uses in central and southern Utah vis a vis the primary north-south highway of U.S. 89. Or contemplate how the Central Utah Project has enabled the land uses to change in the areas served by this water. Finally, consider how provisions in the U.S. tax code – such as the deductibility of mortgage interest and property taxes – have provided incentives for home ownership at the expense of rental housing.[11]

Likewise, state and local government decisions pertaining to roads, water systems, and tax policy contribute to the mosaic of land uses present. State and local decisions about where to place street interchanges, arterials, and connectors all impact land uses, just as decisions about where to direct and how to pay for water development influence land use. Further, tax policies – such as the distribution of local option sales taxes – influence local decisions about residential, commercial, and industrial development. The point is that land use decisions result from a complex array of federal, state, and local decisions and a truly free market for these decisions does not currently exist.

Free Market Principles

Private property rights, choice, user-based pricing, information, and competition are among the most important characteristics of a market economy. In each of these areas the opportunity exists for more common ground between the ideals of quality growth planners and free market economists.

Private Property Rights

Voluntary programs to conserve critical lands are being widely promoted by the leaders of the quality growth dialogue. The emphasis on voluntary programs now could preclude more mandatory changes later because of federal government intervention. Market-based land conservation techniques involve willing buyers and willing sellers. Land owners are not penalized for exercising their own rights about how to use their land. Restrictions on use stem from existing federal, state and local laws, many of which could be made more flexible as part of quality growth planning efforts.

Choice

Zoning practices are critical to all land use decisions. Quality growth planning has stimulated discussion about zoning reforms that

[11] See the work of Richard Voith, an economic advisor in the Research Department of the Philidelphia Federal Reserve Bank. His article titled, "Does the Federal Tax Treatment of Housing Affect the Pattern of Metropolitan Development," (March/April 1999, Business Review, Federal Reserve Bank of Philidelphia) concludes that U.S. tax treatment of housing effects household choices regarding where to live and how much land to consume.

respond to market trends such as the proliferation of home offices, need for rental housing, and demand for granny flats or mother-in-law residences. Zoning that responds to market trends would increase individual choice and freedom.

For instance, there is significant evidence currently that developers in Utah want and are prepared to meet the demand for moderate and low income housing, but are precluded from doing so by local government policies. The same is true for some home-based businesses. Local ordinances often prevent certain types of activities in residential areas.

Zoning concepts that provide for greater flexibility in land use management include mixed-use development, cluster housing, planned unit developments, conditional uses, flexible zoning, and performance zoning.[12] These practices are not appropriate in all settings, but can be helpful in accommodating market activity when deemed appropriate.

User-Based Pricing

Infrastructure investment decisions for transportation, water, sewer, and utilities impact land use by making lands accessible and inhabitable. These decisions impact the marketplace by changing the value and uses of land. Since a portion of the costs for new development are shared among all residents, hidden subsidies to locate on urban fringes may occur.

A good example of a hidden subsidy is the financing for water development. A portion of general property taxes and sales taxes are used for water development even though treated water is metered throughout the Greater Wasatch Area. This means that even after paying the metered price, and in many cases an impact fee, a portion of the costs for the storage, treatment, and distribution of water is paid by all residents. In many cases this results in a subsidy for new development because many water costs are a function of use (outdoor watering) and distance (linear feet of pipeline). The subsidy is larger for bigger lot sizes and more dispersed development.

The quality growth dialogue illuminates this dilemma and raises important questions about who should pay and how much they should pay for various infrastructure investments. Pricing on-site public services at their cost would change incentives. Quality growth planning provides a forum for discussing this and other market pricing issues such as peak/congestion pricing, toll roads, impact fees, and transportation and water financing.

Information

Markets perform more efficiently when information is accurate and readily available. A primary role of government in a market economy is providing information. Government involvement is deemed appropriate because information is costly to develop and disseminate. The public sector is also well-suited to define the standards of economic accounting and convey public information about price levels, employment, wages, and other economic and geographic measures. In contrast, private information is often proprietary, protected, or patented.

As part of the quality growth planning efforts, state and local governments have organized valuable information about land constraints (wetlands, flood plains, natural hazards, etc.); economic and demographic trends (projections

[12] See *Special Zoning Methods*, University of Utah, Center for Public Policy Administration, for a practical discussion about creative zoning techniques.

about the level, distribution, and characteristics of the population); water supply (areas likely to have future constraints); and other factors that inform decisions made by the private sector. This information helps the market to function better by providing entrepreneurs with more and better information to make decisions.

Competition

Competition improves productivity and increases wealth. By reducing restrictions in the marketplace (such as zoning ordinances); promoting voluntary, mutually beneficial exchange (such as conservation of critical lands); and, providing information (such as land constraints and economic and demographic trends), the competitive environment is enhanced. Quality growth planning can serve to increase competition rather than limit it.

Summary

The potential exists for the public dialogue about quality growth to result in freer markets and a level of government involvement that would be deemed more appropriate by many. Decisions about how and where we grow, as well as how we pay for growth, should be actively discussed. Envision Utah and the Quality Growth Act of 1999 provide a forum for this discussion. The relationship between quality growth and market principles is an important aspect of this grand dialogue.

Appendix G:
Urban Systems Model: Urban Sim

During the 1990s, best practice for transportation planning agencies came to include modeling the interaction between travel behavior and land use. In order to facilitate best practice at Utah's transportation planning agencies, the QGET Technical Committee decided to develop an urban systems model for the urbanized area along the Wasatch Front. During the fall of 1997, the Technical Committee formed a model selection committee to solicit and evaluate proposals from urban modeling contractors.

The selection committee included representatives from the following agencies:

- Utah Automated Geographic Reference Center (AGRC)
- Utah Division of Air Quality (DAQ)
- Utah Department of Workforce Services (DWS)
- Utah Governor's Office of Planning and Budget (GOPB)
- Mountainlands Association of Governments (MAG)
- University of Utah Department of Geography
- Wasatch Front Regional Council (WFRC)

With the guidance of the Utah Division of Purchasing, the selection committee designed a process to select a modeling contractor. The process used by the selection committee conformed with the rules developed by the Purchasing Division, which attempt to insure contracts are awarded fairly and that public resources are not wasted.

MAG and WFRC have been designated by the U.S. Department of Transportation as the local transportation planning agencies for the Wasatch Front urban area, and are known as Metropolitan Planning Organizations (MPOs). The two MPOs, MAG and WFRC, will be primarily responsible for the urban systems modeling done of the Wasatch Front urbanized area.

The selection committee sent requests for qualifications (RFQ) to about 20 contractors. In response to the RFQ, 11 contractors submitted statements of qualifications (SOQs). A scoring procedure was established to evaluate the SOQs based on the following broad categories:

- Proven ability of the software to incorporate model requirements
- Ability of the firm to complete similar contracts in a timely manner within budget
- Experience and qualifications of the individuals providing services

Based on the SOQ scoring, five contractors were invited to Utah to present their proposals to the selection committee. After viewing the presentations and discussing the relative merits, the selection committee selected the UrbanSim modeling system developed by Dr. Paul Waddell, a professor of urban design and planning at the University of Washington. A contract with Dr. Waddell was signed in the winter of 1998 and work on implementing UrbanSim in Utah has been underway since.

The selection committee was particularly impressed with Dr. Waddell because he had had practical experience with a transportation planning agency earlier in his career and therefore understood the day-to-day issues

involved with modeling travel behavior. As a review sponsored by the U.S. Department of Transportation noted, UrbanSim "is consistently based throughout on an extremely rigorous and compelling application of microeconomic theory."[13] In addition to being impressed with Dr. Waddell on a personal level, and with the theoretical structure of his model, the selection committee was pleased that UrbanSim integrates well with the current travel models being used by the MPOs.

Key features of UrbanSim include:

The model simulates the key decision makers and choices impacting urban development; in particular, the mobility and location choices of households and businesses, and the development choices of developers;

The model explicitly accounts for land, structures (houses and commercial buildings), and occupants (households and businesses);

The model simulates urban development as a dynamic process over time and space, as opposed to a cross-sectional or equilibrium approach;

The model simulates the land market as the interaction of demand (locational preferences of businesses and households) and supply (existing vacant space, new construction, and redevelopment), with prices adjusting to clear market;

The model incorporates governmental policy assumptions explicitly, and evaluates policy impacts by modeling market responses;

The model is based on random utility theory and uses logit models for implementation of key demand components;

The model is designed for high levels of spatial and activity disaggregation, with a zonal system identical to travel model zones;

The down side of UrbanSim's rigorous theoretical foundation has been a time consuming data development requirement. In order to be valid, a model such as UrbanSim must be calibrated to local conditions. The MPOs and AGRC have been the lead agencies in developing the data needed to calibrate UrbanSim.

Two data sources were particularly troublesome: employment by job site and real estate by parcel. Employment by job site had to be geo-coded, which took several weeks. Real estate by parcel had to be organized from digital tax assessor files, and in cases where the data was missing, purchased from a private vendor. Developing these datasets and integrating them with other data sources was done during 1998 and 1999.

The tool being used in the data development is geographic information systems (GIS). GIS is most powerful when land area can be organized into grids. Gridding allows spatial analysis of data without the constraints of geographic boundaries. Once data has been gridded, it can be mapped to any geographic area. Gridding data is time consuming, but the reward in terms of enhanced analytical capabilities is worth the effort. Because of the advantages of gridding, both Dr. Waddell and AGRC wanted it done. The MPOs and GOPB agreed, and late 1999 was

[13] *Integrated Urban Models for Simulation of Transit and Land-Use Policies*, Eric Miller, David Kriger, and John Hunt (September 1998), page 100.

spent gridding the various datasets used to calibrate UrbanSim.

At the time of publication, UrbanSim is being beta-tested at GOPB. The model is running well, but a number of issues will need to be resolved before it becomes fully functional at the MPOs. The primary issue is the interface between UrbanSim and the travel models. The structure and composition of the files output from UrbanSim to be input to the travel models needs to be resolved. Another large concern is sensitivity testing of the model to see if there are problems with the model's structure or the input data used in calibration. The current schedule is to wrap up beta-testing in 2000 and begin implementing UrbanSim at the MPOs in 2001. While UrbanSim will be ready for the MPOs to use, it will take some time before UrbanSim completely replaces the MPOs previous methods. Part of that time will be spent comparing results from UrbanSim and previous methods, and part of the time will be spent gaining a deep understanding of UrbanSim's abilities and limitations.

Appendix H: Cool Communities and the Urban Heat Island Pilot Project

Population, urban expansion and commercial development are on the rise in metropolitan Salt Lake City and surrounding urban areas. Emerging development and urban growth cause energy, air quality and environmental problems that could adversely affect the people and children that live and work in this uniquely situated city. As urban centers expand and green space disappears, cities become hotter, the production of energy increases (giving rise to CO2 emissions), ground-layer-ozone development is exacerbated, and people become disconnected to their natural environment. These ramifications are in part caused by a phenomenon known as the "urban heat island" effect. Increases in impervious surfaces and a reduction in vegetation attendant to urbanization capture and retain solar energy, thereby increasing air temperatures.

A consequence is the reduction of livability in the urban environment at the human scale. Dark-colored surfaces, such as those found on pavements and rooftops, exacerbate this urban heating, causing sweltering temperatures, high utility bills and poor air quality. These dark-colored surfaces absorb solar radiation, converting this energy into heat, which is emitted back into the ambient air. Heightened air temperatures can exacerbate the formation rate of ground-layer-ozone, a hazardous air pollutant that develops from the mixing of various air pollution sources.

An increase in energy consumption is another consequence of heightened air temperatures. If the air conditioner is used more frequently as a result of hotter summertime temperatures, there is greater demand on energy use. This generates high utility bills to consumers and increased demand on power plants (prime emitters of CO2). In addition, an overall reduction in human and animal comfort levels can be expected if urban air temperatures increase.

The Program

Implementing strategies of the nationally recognized Cool Communities program can reduce negative impacts of "urban heat islands" on the urban environment. Using light-colored (or more reflective) surfaces on buildings, streets, parking lots and rooftops will help to reduce these high temperatures, as will the continued use of drought tolerant deciduous and coniferous trees, shrubs and ground covers, which evaporate cool water vapor into the air while directly shading and protecting buildings, streets, and parking lots. Trees and other vegetation work to not only cool and shade urban areas, but also to remove airborne particulate matter, beautify communities, increase property values in residential and commercial areas, sequester CO2, improve resource and energy efficiency, decrease erosion, and manage storm-water runoff.

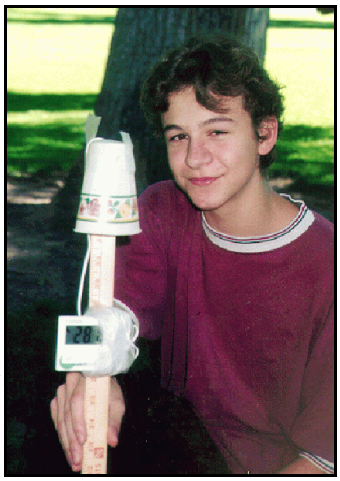
Program Components

A research component of the Salt Lake City Cool Communities program is the U.S. Environmental Protection Agency's "Urban Heat Island Pilot Project (UHIPP)," a collaborative endeavor with the U.S. Department of Energy,

the National Aeronautics Space Administration's (NASA's) Global Hydrology and Climate Center, and many local Cool Communities partners. The goal of this partnership program is to analyze the role "urban heat islands" play in rising temperatures, increased energy consumption and degraded air quality in the Salt Lake Valley area. To facilitate this study, a NASA Lear jet equipped with thermal imaging devices flew over the Salt Lake valley on July 13, 1998 and took thermal "snap-shots" in order to better understand which surfaces contribute to or drive the development of urban heat islands. These images provide core data for planners,

developers and architects toward the implementation of Cool Communities strategies throughout the Salt Lake Valley.

Another important component of Cool Communities is education. Youth in the community are reached through "Kool Kids," a program that actively engages and educates elementary school students with hands-on research activities and improved science curriculum on the "urban heat island" phenomenon and attendant energy, air quality and human comfort ramifications. "Kool Kids" is co-funded by Utah Power and has primary goals of reducing CO2 emissions, improving energy efficiency and empowering youth to make educated decisions with regard to their local community. Cool Communities also educates the general and professional community about ramifications of urban growth, reduced vegetation and unmanaged development. State and local governments, architects, urban planners, landscape architects, engineers, private industry, research and science are all professional fields served by Cool Communities and its educational programs. These sectors benefit from increased knowledge and awareness about improved development and landscaping practices.



QGET and Cool Communities

Along with community and youth education, another primary means of information dissemination is through the Quality Growth Efficiency Tools (QGET) Technical Committee, which provides technical support to Envision Utah, making it possible to analyze a baseline future, growth alternatives, and, now, the Quality Growth Strategy for improved Utah communities. Cool Communities and QGET share a common interest to analyze growth issues related to planning, land use, transportation, air quality and other environmental concerns associated with rapid expansion. As such, these organizations share information, strategies and visionary policies to enhance Utah's quality of life for current and future generations. This may include sharing maps, baseline scenarios and general theories to help state and local governments make appropriate decisions regarding open space, transportation, development and growth management.

Program Activities
Cool Communities and UHIPP seek to improve state and local government development ordinances so that building and landscaping practices are improved relative to energy use, air quality and resource management. Recent ordinances passed to reflect Cool Communities strategies include:

- Salt Lake City amended its existing landscape ordinance so that trees are required within the interior section of certain commercial parking lots (rather than just on the periphery), thereby substantially cooling and shading pavements, vehicles and pedestrians;

- Salt Lake City has included Cool Communities strategies in its master plan for the "Gateway District," an urban renewal area west of downtown, so that new and retrofitted buildings contain light-colored roofs and parking lots with strategically planted trees for maximum shading; and

- Highland, Utah has included in its Town Center ordinance reflective roof surfaces, abundant use of strategically planted and drought-tolerant trees, and the use of a compensatory parking lot requirement: the use of concrete materials are used in parking lots unless developers double the amount of trees planted in and around parking lots.

These unprecedented municipal ordinances are models for other cities throughout Utah, and throughout the nation, which encourage the use of cost-effective, timely and sustainable strategies to improve urban communities.

Other milestones of the Cool Communities program are:

- Inclusion in Envision Utah's Quality Growth Strategy, a guide for local communities to preserve Utah's environment, economic strength and quality of life;

- Board member representation in the Cool Roof Rating Council, a nationally recognized not-for-profit organization, which seeks to rate and label reflective roofing products for market transformation;

- Excellent attendance and recognition at the "Cool Concept for Cities & Towns" Conference (October 1999), which brought together architects, planners, scientists, industries, landscape architects and others to address pressing urban growth issues in our communities;

- Representation in highly recognized organizations such as the Utah Water Conservation Forum, American Planning Association, Utah Environmental Education Council, Project Learning Tree and the Memory Grove Restoration Committee; and

- Development of local demonstration projects that display on-the-ground strategies for improved community and professional awareness of Cool Communities.

Conclusion
Demonstration projects, increased education and awareness, improved research and changes in local and state government development policies related to landscaping, roofing and pavements are methods used by Cool Communities to

improve our urban environment for generations to come. Additionally, Cool Communities engages in opportunities to broaden the nature and understanding of sustainable development by encouraging pedestrian-friendly streets and tree-lined sidewalks, bicycle paths, alternative forms of transportation, and improved overall urban surroundings, health and aesthetics.